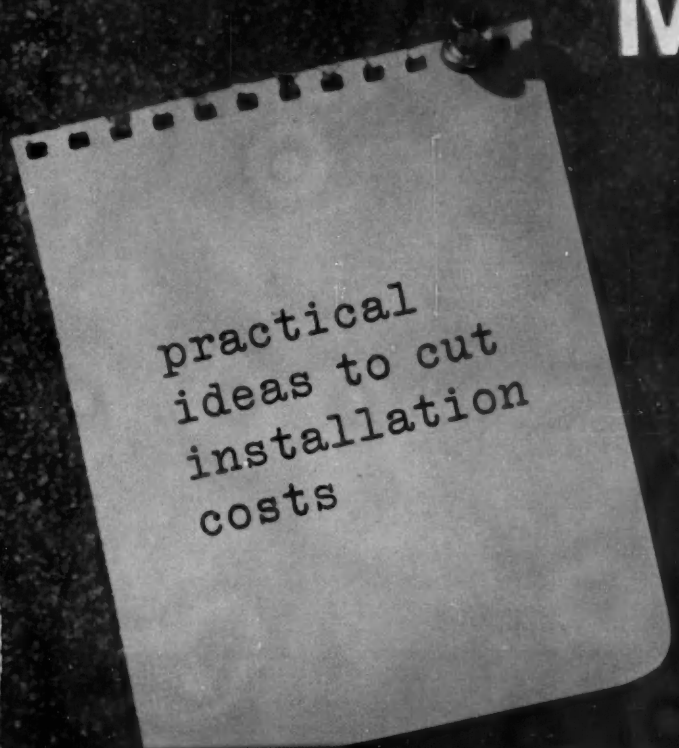
JULY
1962

PRICE 75 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

1962 TOOLS AND METHODS REPORT



A McGRAW-HILL PUBLICATION

61ST YEAR

steel

we don't skimp on steel—all major parts are made of 20 U.S. gauge steel. Our cost: 64c more per 2x4 troffer—including freight!

zinc plating

every piece of steel is zinc-coated on both sides. Guth fixtures should never rust. Our cost: 71c more per 2 x 4 troffer.

the guth creed

for good LIGHTING FIXTURES

- we aim to produce better lighting fixtures – not cheaper ones
- we engineer fixtures – not bargains
- we are a quality manufacturer – not a discount house
- we save at the right places – for your benefit • not at the wrong places – for your grief
- we are lighting engineers – not scrap-pile suppliers
- we build to a standard – not to a price
- we believe in this formula for fixture evaluation:

Price divided by Service Years

acrylic paint

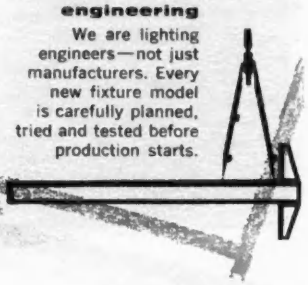
stays sparkling white longer—easier to clean—finish 175% harder—resists to chipping, scratching, fumes and discoloration. Full 1¼ mil thickness. Our cost: From 28c to 96c more per 2x4 based on same paint thickness.

bonderizing

costly precision equipment prepares the surface for better paint adherence—plus zinc phosphatizing treatment AFTER forming!

engineering

We are lighting engineers—not just manufacturers. Every new fixture model is carefully planned, tried and tested before production starts.



structural integrity

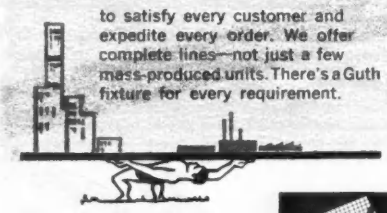
our fixtures are designed and assembled for strength. Heaviest cold-rolled and die-forming equipment. Riveting for strength. Made stronger to last longer.

quality control

every luminaire is lighted and must pass several thorough tests before found worthy of our customers. We periodically heat and sound test our ballasts, check paint quality, test individual luminaires for light output and mechanical soundness.

we bend over backwards

to satisfy every customer and expedite every order. We offer complete lines—not just a few mass-produced units. There's a Guth fixture for every requirement.



Guth 60 YEARS OF LIGHTING

GUTH means: more fixture — better light — more footcandles — longer life . . . Convince yourself.

write to us or ask our customers

THE EDWIN F. GUTH CO.
2615 Washington Ave. Box 7079 St. Louis 77, Missouri

Eliminate Scrap—Reduce Cutting with SQUARE D UNDERFLOOR DUCT!

Exclusive Modular Design SIMPLIFIES THE JOB...TREMENDOUSLY

Actually, we've understated our case—for on jobs involving spans of 21 feet or more (and the vast majority do), there's no cutting and no scrap! Why? Because Square D's Underfloor Duct is furnished in four lengths—5', 6', 10', and 12'. With combinations of these four, you can meet any footage requirement, from 21' on up!

Every electrical contractor who has installed an underfloor duct system the old way knows that cutting on the job is a costly time-consumer. The problem of unavoidable scrap is an equally bothersome headache.

There's a lot of food for thought in the comparison shown below. Look it over and if you'd like the complete story of Square D Underfloor Duct, drop us a line.

Here's a Typical Comparison

THE OLD WAY						THE SQUARE D WAY					
RUNS BETWEEN BOXES	CUTS PER RUN	SCRAP PER RUN	NUMBER OF RUNS	CUTS PER FLOOR	SCRAP PER FLOOR	RUNS BETWEEN BOXES	CUTS PER RUN	SCRAP PER RUN	NUMBER OF RUNS	CUTS PER FLOOR	SCRAP PER FLOOR
27 ft.	2	3'	36	72	108'	27 ft.	0	0	36	0	0
5 ft.	2*	5'	24	48	120'	5 ft.	0*	0	24	0	0
TOTAL CUTS PER FLOOR.....120 TOTAL SCRAP PER FLOOR...228 ft. (over 20%)						TOTAL CUTS PER FLOOR....0 TOTAL SCRAP PER FLOOR...0					

Unbelievable? The clue is in the insert location

write for Underfloor Duct Bulletin
Square D Company, Mercer Road, Lexington, Kentucky

SQUARE D COMPANY

wherever electricity is distributed and controlled

ALL NEW—ALL DIFFERENT

the finest Quartzlite 500 You Can Buy!

This Appleton Quartzlite 500 utilizing the powerful 500 watt Quartz-Iodine Lamp, stands out above all others on the market. It has exclusive features found in no other unit and is engineered to give more trouble-free service outdoors or in, than ever before possible.

HERE'S WHY!

The new Appleton Quartzlite 500 has an exclusive one-piece cast aluminum housing heavily finned for heat dissipation and exceptional rigidity. A new weatherproof self-locking cover is fitted with a special one-piece moulded silicone rubber gasket that will prevent the entrance of moisture even if the latch should be left open, or jolted open by accident.

Mounting may be made directly to ¾" rigid conduit because of the compact, light weight design and construction. Three efficient beam spreads are available: wide, medium and narrow.

Your Appleton Franchised Distributor will give you all the details. Call him for immediate service.

APPLETON ELECTRIC COMPANY
1701 Wellington Avenue
Chicago 13, Illinois

APPLETON®

W. T. STUART, *Editor*

Alice McMullen, *Managing Editor*

Associate Editors
Berlon C. Cooper, *New York*
August Eckel, *Chicago*
J. F. McPartland, *New York*
W. J. Novak, *New York*
Hugh P. Scott, *San Francisco*
John H. Watt, *New York*

Art Editor
L. E. Devendorf

Assistant Editor
R. J. Lawrie

Editorial Assistant
Mary A. Corich

Consulting Editors
Ray Ashley, *Chicago*
R. L. Lloyd, *Washington, D.C.*
B. Z. Segall, *New Orleans*
R. E. Ward, *Nashville*
Douglas Greenwald, *Man., Economic Services*
George B. Bryant, Jr., *Chief Correspondent, Washington Bureau*
John Wilhelm, *Manager, News Bureaus*

W. W. GAREY, *Publisher*

A. L. De Weerdt, *Circulation Manager*
W. C. Carmichael, *Business Manager*
Ann P. Barrett, *Production Manager*

R. A. Hubley, *Advertising Sales Manager*

A. B. Conklin, *New York*
E. P. Gardner, *New York*
A. E. French, Jr., *Philadelphia*
F. J. Seiler, *Cleveland*
J. E. Lange, *Detroit*
H. E. Green, Jr., *Chicago*
R. R. Ream, *Chicago*
John Hernan, *San Francisco*
F. E. Le Beau, *Dallas*
D. O. Hanson, *Houston*
R. S. McGinnis, *Los Angeles*
R. H. Powell, *Atlanta*
Scott Hubbard, *Portland*

Member of
AUDIT BUREAU OF CIRCULATION and ASSOCIATED BUSINESS PUBLICATIONS

Vol. 61, No. 7 July 1962
ELECTRICAL CONSTRUCTION and MAINTENANCE

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: **McGraw-Hill Building, 330 W. 42nd St., New York 36, N.Y.** Printed in Albany, N.Y. **Officers of the Publications Division:** Nelson L. Bond, President; Shelton Fisher, Wallace F. Traendly, Senior Vice Presidents; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator. Daniel F. Crowley, Vice President and Controller. **Officers of the Corporation:** Donald C. McGraw, President; Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Executive Vice President and Treasurer; John J. Cooke, Vice President and Secretary.

This publication is available only by paid subscriptions which are solicited from persons engaged in electrical construction, maintenance or consulting services. The publisher reserves the right to refuse subscription service to others. **Position and company connection must be indicated on subscription orders.**

United States subscription rate for individuals in the field of the publication $3.00 per year. This issue 75 cents. Electrical Products Guide $2.50. Canada $5.00 per year. All other countries, $25.00 per year, payable in advance. Second class postage paid at Albany, N.Y., and at additional mailing offices. Printed in U.S.A. Title registered in U.S. Patent Office. © Copyrighted 1962 by McGraw-Hill Publishing Co., Inc. — All rights reserved.

UNCONDITIONAL GUARANTEE: Subscription service may be discontinued at any time on written request by the subscriber. The publisher will refund the part of the subscription price applying to the remaining unfilled portion of the subscription.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

61ST YEAR • JULY 1962

Sidelights 5
Washington Report 7
New Manpower Needed, An Editorial 85
1962 Tools and Methods Report 87

How contractors apply modern tools and time-saving techniques to lower installation costs of electrical projects. A review of field practices adaptable to a wide variety of job conditions.

Material Handling 89
Scaffolding and Platforms 94
Fastenings and Supports 98
Assembly Techniques 103
Conduit and Raceways 108
Cable Handling 112
Underground Work 116
Pole and Line Work 120
Temporary Power Facilities 124
Alteration Work 126
Job Communication 130
Tools for Maintenance 132

Practical Methods 139

Lighting benefits measured by audits; infrared heat warms outdoor service center; dry drilling speeds cutting of slabholes.

Reader Service 155

Product news announcements, catalogs and bulletins.

Reader's Quiz 177

Questions and answers on protecting high-voltage motors; multiple-control for dimmers.

Questions on the Code 185

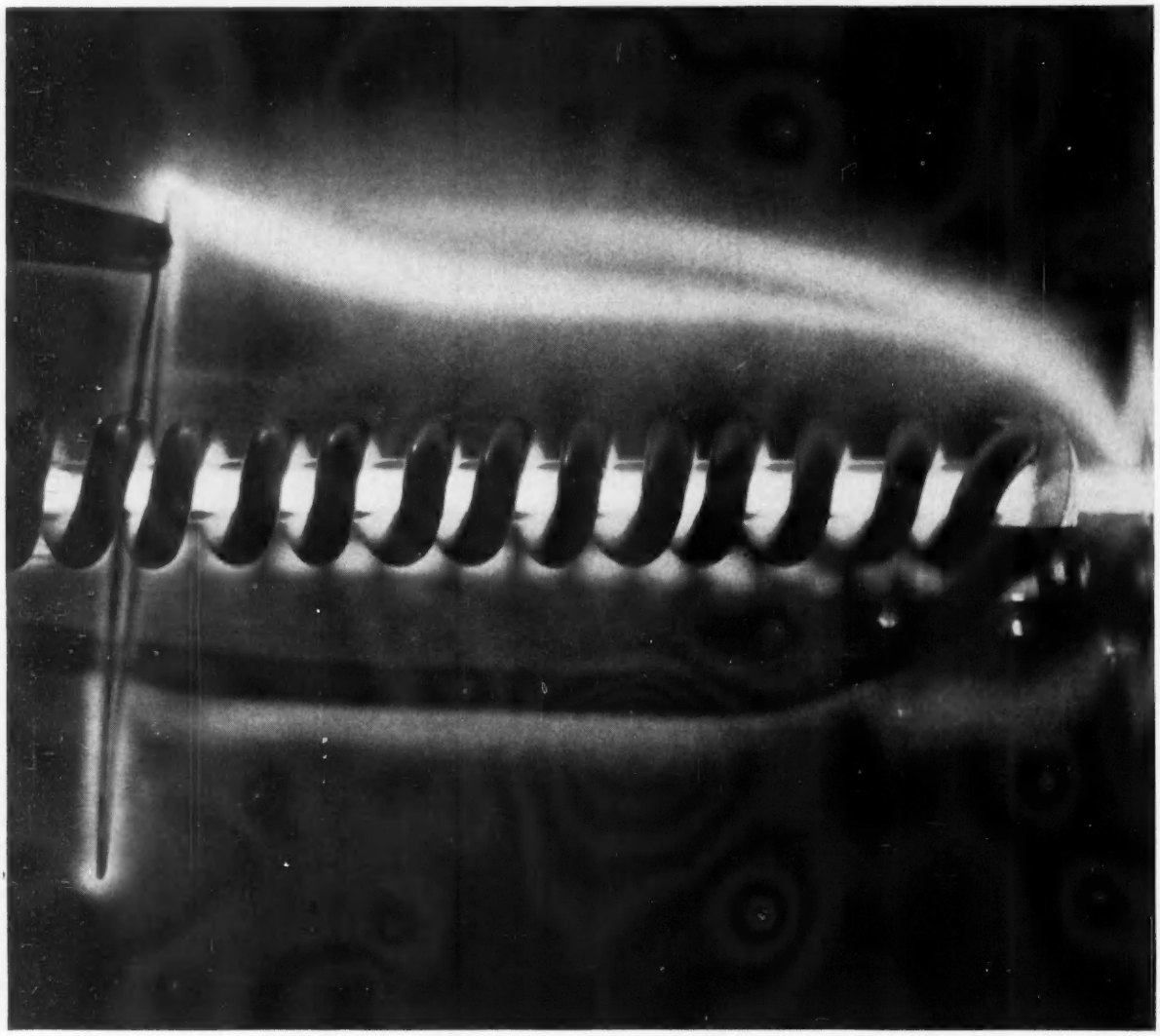
Answers to code questions on clock outlet; protecting equipment from remote hazards; store lighting.

In the News 203
Dates Ahead 213

SUBSCRIPTION: Send subscription correspondence and change of address to Subscription Manager, Electrical Construction and Maintenance, 330 West 42nd Street, New York 36, N.Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical Construction and Maintenance, 330 West 42nd St., New York 36, N.Y.

SILICONE RUBBER News from Dow Corning



Here's how **Silastic** works for you

Ever seen insulation at work? This is a corona discharge caught by the camera. The wire under test has insulation made from Silastic®, the Dow Corning silicone rubber. Silastic samples, subjected to over 12,000 hours of this test which creates a high concentration of ozone, show no signs of cracking or checking when removed from the test fixture and flexed.

Silastic has other important properties which make it ideal for electrical wire and cable use. Some of these properties are listed in the chart at the right. Why not send for more complete technical information today?

Properties of Silastic that work for you

FLEXIBLE AND STABLE from —130 to 500 F

HIGH DIELECTRIC STRENGTH under adverse conditions . . . even the ash of Silastic provides good insulation if dry and intact

INERT TO OXYGEN, OZONE and many chemicals

UNAFFECTED BY MOISTURE—water, vapor or steam

DOESN'T CRACK OR CHECK from weathering

LITTLE DETERIORATION due to age, thermal cycling or exposure to radiation

For complete data on Silastic as Wire and Cable insulation, write Dept. 3107, Dow Corning Corporation, Midland, Michigan.

first in silicones

Dow Corning

Sidelights

TOOLS AND METHODS

A major portion of the editorial contents of this issue is devoted to a special report on cost-saving job methods and tooling. Prepared by Associate Editor August Eckel, the report covers a wide variety of current practices on several classes of work. Each section is introduced with a handy check list to check against your own tools and equipment supply and prospective needs.

SELECTING ELECTRICAL EQUIPMENT

The original editorial project, "Selecting Electrical Equipment," by J. F. McPartland and the Editors of Electrical Construction and Maintenance, published in our May 1962 issue is now available in a permanent reference edition. The complete work printed in two colors and bound in an attractive hard cover is priced at $5.00 each. It may be obtained from the Editorial Department, Electrical Construction and Maintenance, 330 W. 42nd St., New York 36, N. Y.

CODE CHANGES

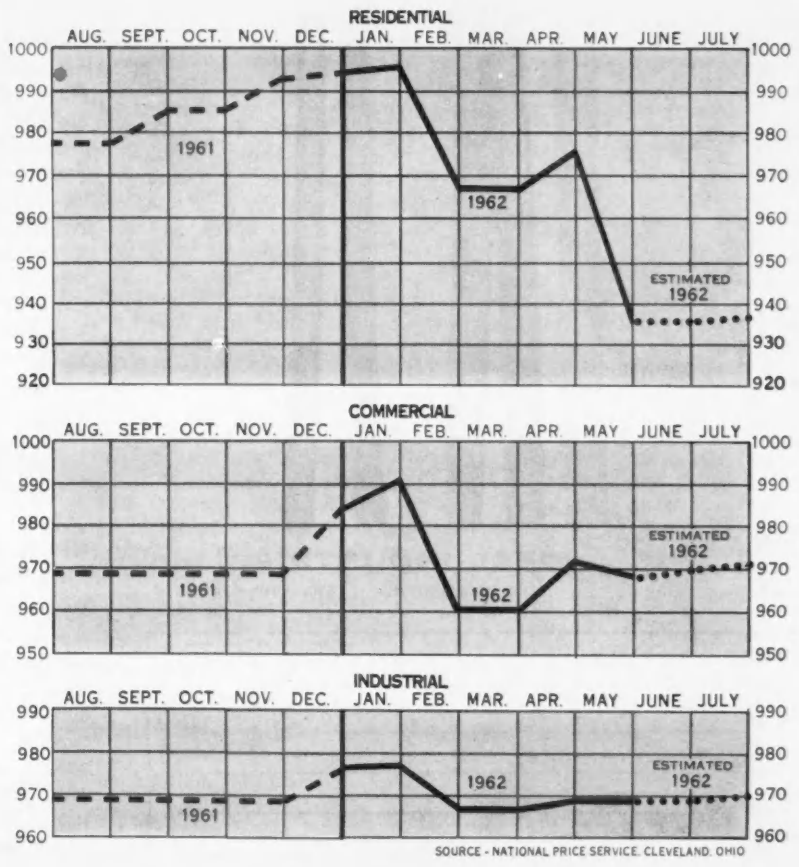
The forthcoming 1962 edition of the National Electrical Code has been completed and is expected to be issued shortly after September 1. Associate Editor John H. Watt has been following closely the revision procedures through the Panels and up to final adoption by the Correlating Committee and the NFPA. From his long experience with code interpretation and application he is well equipped to select those items in the coming 1962 revisions which are of the most importance to the industry. His preview and analysis of the most significant changes will appear in a special report "Highlights of the 1962 National Electrical Code" in our August issue.

ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

THE BASE (1000) REPRESENTS THE AVERAGE COST OF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

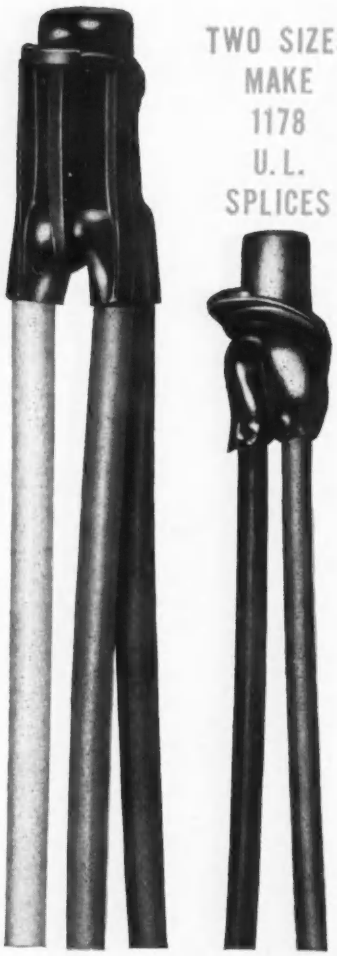
WRAP-UP ALL YOUR SPLICING NEEDS

with only

2

IDEAL

CRIMP CONNECTORS



Ideal's two sizes of steel sleeves and WRAP-CAP "all-around" insulators will probably handle every splice you'll ever make. Listed for one #18 with one #14, to one #6 and two #8—1178 combinations in all!

Greater holding power, too... greater than any other crimp connector used for pigtail splices. One-piece WRAP-CAP easily slides over even largest splice... completely insulates joint, even between wires. U.L. and C.S.A. listed for general use (600v) in branch circuit and fixture wiring, 1000v for signs and fixtures.

New Crimp Tool—Makes Splicing Easier Than Ever Before!

Makes short work of even the largest crimps. A gentle, *one hand* squeeze and the job's done! Makes right-angle indents for tightest joints. Shear type cutter slices through toughest wire bundles, serrated nose grips, twists, deburrs—cleanly, easily. Replaces a whole pocketful of tools!

Sold through America's Leading Distributors
In Canada: Irving Smith Ltd., Montreal

IDEAL the helping hand on every wiring job.

IDEAL INDUSTRIES, Inc.
1041-G PARK AVENUE SYCAMORE, ILLINOIS

FREE SAMPLES! Fill in and mail coupon. See how Ideal CRIMP CONNECTORS work—on big splices and small!

NAME_____

ADDRESS_____

COMPANY_____

CITY_____ ZONE____ STATE_____

Washington Report

JULY • 1962

The national economy enters the third quarter with many bright spots, despite the recent plunge of the stock market, and the Administration-inspired question of confidence, by businessmen and consumers, in over-all Government economic policy. These bright spots include:

- **Personal income** in May was at an all-time record of $440 billion, compared with $413.2 billion in May 1961.
- **Retail sales,** in May were $19.5 billion, seasonally-adjusted, second only to the April rate of $19.6 billion.
- **Industrial output** edged up slightly in May to 118% (of 1957 average).
- **Employment** in May was 68.2 million, a record for the month, while unemployment fell slightly to 3.7 million, down to 5.4% of the total labor force. (Between 1931 and 1940 unemployment never dipped lower than 14.3% of the labor force.)
- **Housing starts** in May hit an annual rate of 1,587,000, up 3% from April and 23% from May 1961.

The economy also has some weak spots which are causing much concern in Washington, as well as by businessmen and consumers. These include:

- **Gross national product** in second quarter was about $556 billion annual rate, $14 billion below the Administration's forecast of last January. Further advances this year are expected to be small. Production of autos, steel, appliances are at their estimated peak, and housing starts and corporate profits are at their estimated high rates for 1962.
- **Capital expenditures** may reach $38 billion for the year, as forecast by Dept. of Commerce last January, but this is far below the Administration's earlier hopes and plans for $40 to $42 billion.
- **Industrial production,** at an all-time high of 118% in May, will probably decline in last half of year, end up at about 115% (of 1957 average) for the year.
- **Cost-of-Living** is at an all-time record, 105.2% of 1957-59 average, in April.

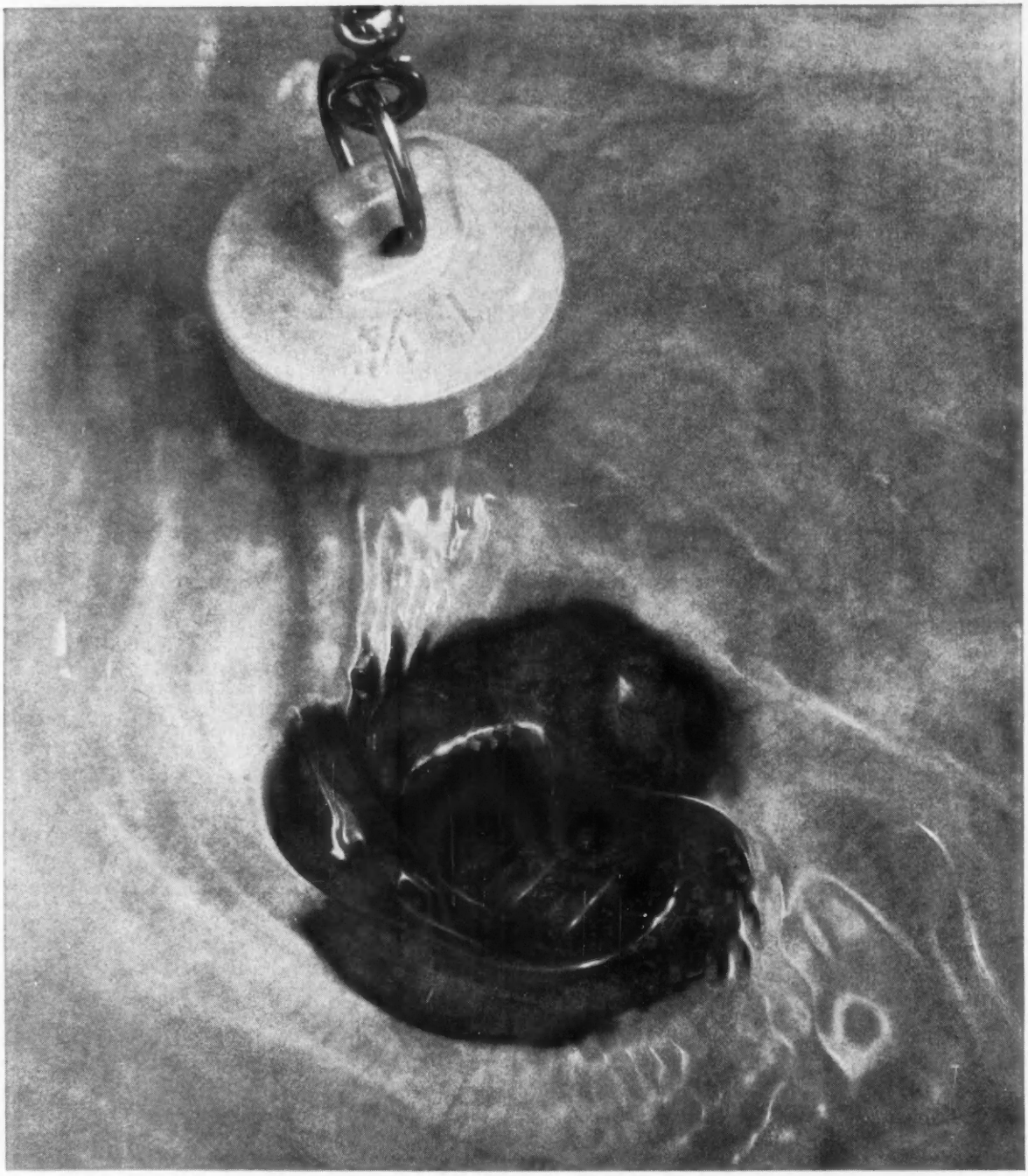
On balance, the economy is now at an all-time high. Economic growth for the remainder of 1962 will, however, probably be spotty—up in some areas, down in others. Economic activity overall will probably trend lower, but there are many positive factors which will help offset any real recession in near future.

Construction spending was up in May. Outlays rose to a seasonally-adjusted annual rate of $59.6 billion, from a $58.3-billion rate in April. Last January Dept. of Commerce forecast a $60-billion construction spending total for 1962, and this rate has been achieved in only one month so far.

Homebuilding is on the rise again. Housing starts in May rose for the third consecutive month, to a seasonally-adjusted annual rate of 1,587,000 units. Apartment building was most active in the revival.

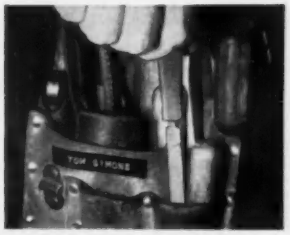
The most recent government survey on plans by business for capital expenditures showed a total for the year of $37.2 billion, an 8% increase over 1961.

Production of electricity is running ahead of year-ago production by about 7%, average, based on weekly reports issued by Edison Electric Institute.



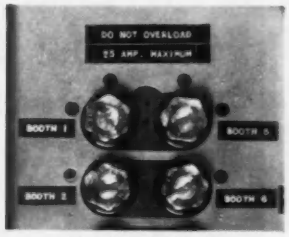
GUESS WHERE A LOT OF YOUR PROFITS WENT? Right down the drain if you're still using old fashioned metal boxes. Contractors everywhere are switching to Union NON-METALLIC new work boxes. You save on the initial cost and more important, you save enough on installation time (as compared to competition) to more than pay for the box. There's no grounding—no box clamps—exclusive plaster seal—handy knock outs. Union boxes are DURABLE—now twice as strong with new Sisal impregnated molding material. Don't forget UNION NON-METALLIC fixtures either. They're non-staining, non-corrosive. They eliminate many grounding problems and have a low unit cost. Complete line—UL approved—Member of NEMA. Contact your distributor now.

UNION INSULATING CO.
PARKERSBURG, WEST VIRGINIA



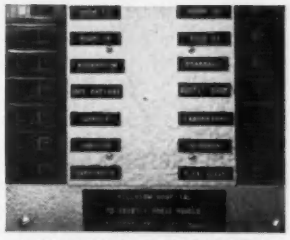
PERSONALIZING

HARD HATS



FUSE BOXES

CONTROL BOXES



CIRCUIT BREAKERS

RAISED LETTER LABELS

MADE ON THE SPOT

If it can be mistaken, mislaid, misfiled, misused, misanything—label it with Dymo. See for yourself how easily you can make handsome, raised-letter labels for 1001 applications. Embossed labels take seconds to make, cost pennies, stick permanently to almost any surface. Vinyl tape in 10 colors, five striped tapes, six metal tapes. Five Dymo Tapewriter models, from $24.95. Send the coupon for a free booklet "1001 Applications" for manufacturing, administrative, inventory, personalizing, professional, electrical, municipal, schools, electronics, and many more – along with a name badge personalized with your name.

Embossed letters provide maximum **permanent** legibility, quality appearance.

DYMO
INDUSTRIES, INC.

Prices slightly higher in Canada

WRITE FOR FREE BOOKLET "1001 APPLICATIONS" AND YOUR SAMPLE NAME BADGE

Dymo Industries, Inc., Department ECM-7
P.O. Box 1030, Berkeley 1, California

Please send me free booklet "1001 Applications" and my name badge as follows.

Name _____ (PLEASE PRINT)

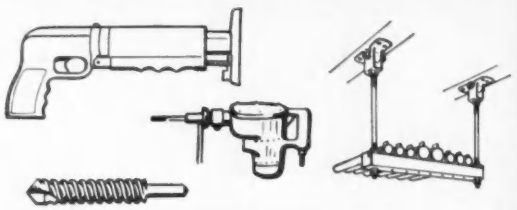
Title: _____ Firm _____

Product or Service _____ Tel. _____

Address _____

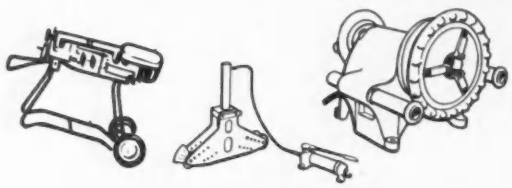
City _____ Zone _____ State _____

PRIME SOURCE

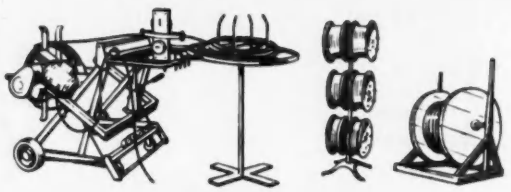


FASTENINGS AND SUPPORTS
Masonry anchors, studguns and studs, masonry drills, hangers, clamps, channel and fittings, slotted angle.

SCAFFOLDS AND PLATFORMS
Scaffolds, stages, adjustable work platforms, ladders of wood, aluminum, magnesium and fibre glass.

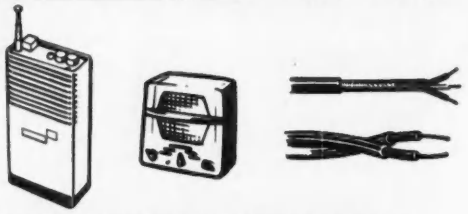


CONDUIT AND RACEWAY TOOLS
Pipe cutters and threaders, hydraulic conduit benders, portable band saws, reamers, wrenches, vises, fish tapes.



CABLE HANDLING TOOLS
Reel trucks and carts, wire storage, wire measuring equipment, cable pullers.

MAINTENANCE TOOLS
Screwdrivers, hammers, gun tackers, hacksaws, steel tapes, soldering irons, voltage testers, pliers, wrenches, portable torches, electric drills, flash lights, lanterns.



COMMUNICATION FACILITIES
Audio hailers, electronic wires and cables, sound and intercommunication equipment.

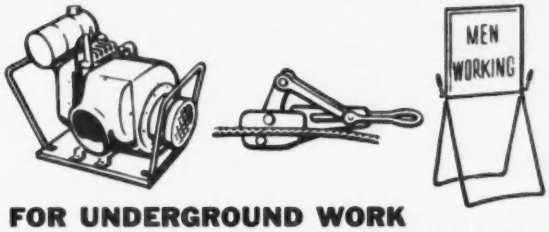
'723

FOR TOOLS

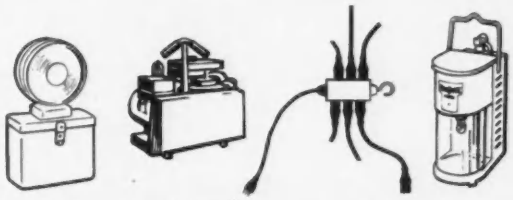
...to speed the job!
...to reduce your costs!
...to make sure of the best!

MATERIALS HANDLING EQUIPMENT
Wire carts, hand trucks, equipment for conduit and wire storage, bins and racks.

MECHANIZED ASSEMBLY TOOLS
Portable electric tools, punches, reamers, electric welders.

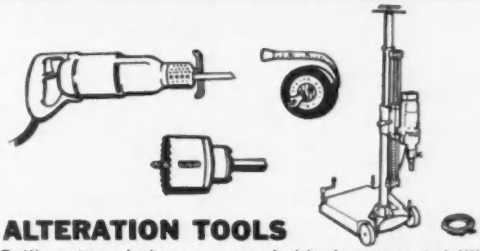


FOR UNDERGROUND WORK
Manhole ventilators, barricades, MEN WORKING signs, pliers, grips.



TEMPORARY POWER FACILITIES
Portable generating plants, heavy duty portable electric distribution systems, warning lights and lanterns.

POLE AND LINE WORK TOOLS
Climbing tools, safety belts, pike poles, digging bars, shovels and other tools.



ALTERATION TOOLS
Drill routers, hole saws, wood chisels, cement drilling machines, extension cords, compass saws.

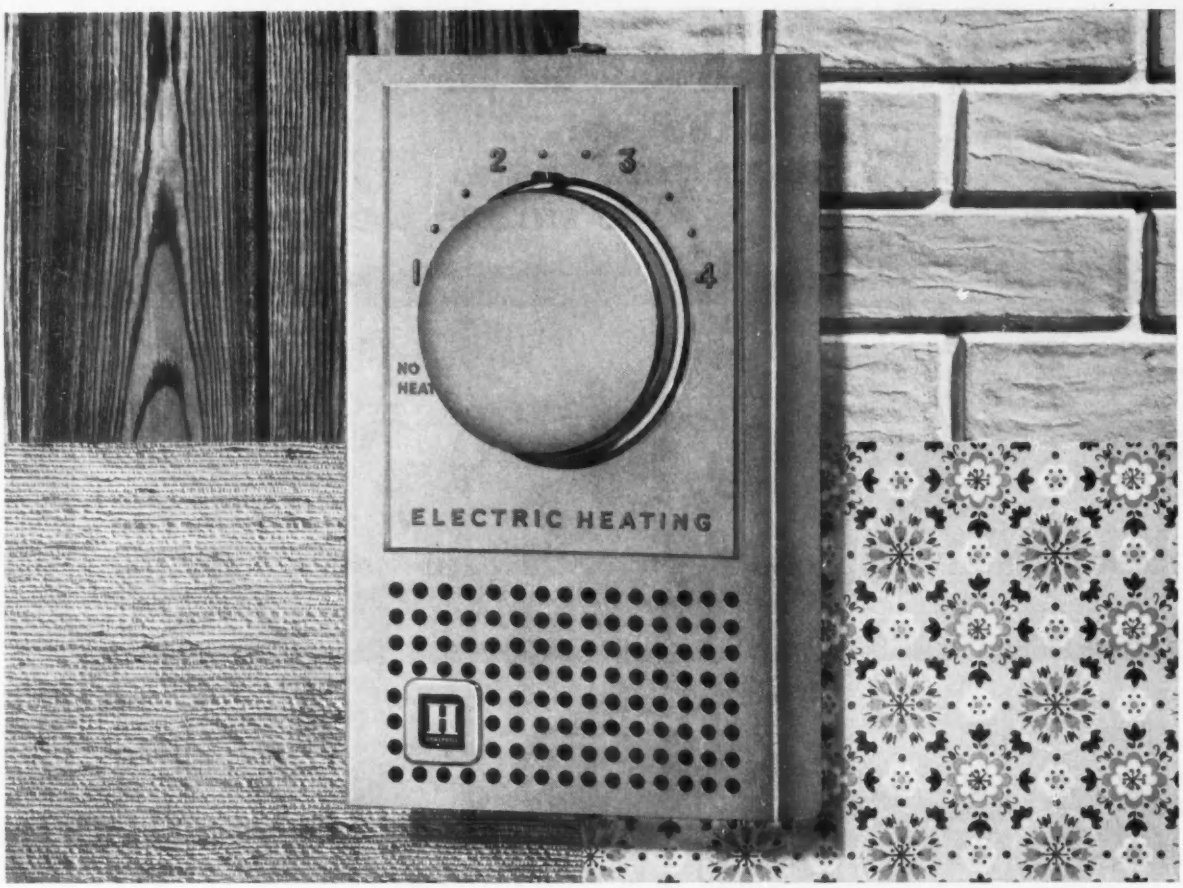
Tools that you buy from Graybar help do the job more quickly, more efficiently and more economically.

Graybar knows electrical equipment inside and out, knows what you want and need, and stocks only the tools that will give top performance for you.

Graybar is the only electrical distributor supplying tools for every type of electrical work. In the 80-page Graybar Tool Catalog for Electricians you'll find all the quality tools you need... to speed the job... to reduce your costs. For your copy, send your name and title on your business letterhead.

For contractors doing pole line construction work, there is also available a 92-page catalog listing Outside Construction Tools and Equipment. Specify if needed. Graybar Electric Company, Inc., 420 Lexington Avenue, New York 17, New York

CALL GraybaR FOR EVERYTHING ELECTRICAL



Put the Honeywell preference to work for you with the stylish

New Honeywell Line-Voltage Electric Heat Thermostat

When Honeywell is on the wall, you're offering what Homeowners want (3 out of 4 prefer Honeywell controls according to a recent survey in cities across the country).

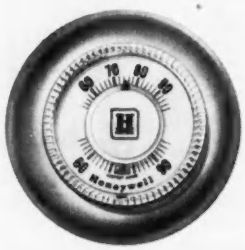
The wall-mounted T462 (above) and its integral unit-mounted counterpart—the T460—are the ideal line-voltage home thermostats. New construction makes them stronger. Now easier to set, too. Rugged and dependable—yet precise (½° differential) switching for operating electric heaters up to 5000 watts, responding to both radiant and convected room heat.

Get the facts about Honeywell. Just call the nearest Honeywell office or write: Honeywell, Dept. EC7-25, Minneapolis 8, Minnesota.

Two switching variations available: T462A and T460C are SPST, make on temperature fall, break line in NO HEAT position. T462B and T460D have the added feature of breaking both lines in the OFF position.

NEW, EXCLUSIVE ELECTRIC HEAT TRAINING PROGRAM!
Another Honeywell first! Sales and service meetings studying a new and thorough working manual: "Fundamentals of Automatic Electric Heating." Call the Honeywell office nearest you about the next session.

Honeywell Low-Voltage Round

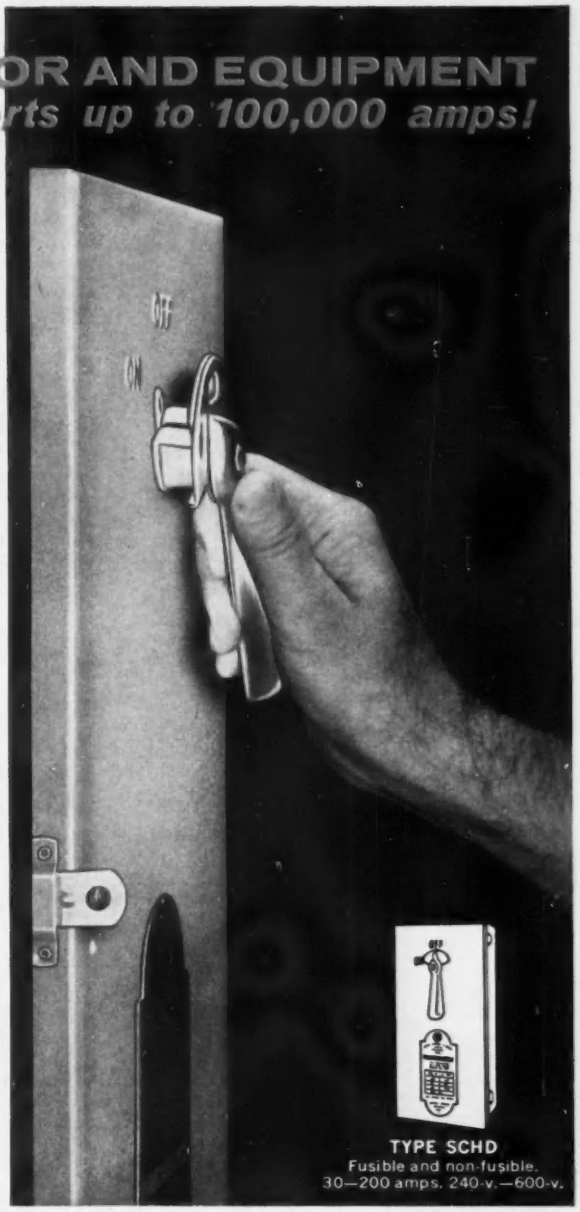


Consider Honeywell low-voltage controls, too. With versatile R8097 Relay, you can offer the widest range of low-voltage thermostat combinations in the electric heating industry. You have complete choice from the most economical to the famous Honeywell Round to the deluxe thermostats and Control Centers.

Honeywell

H HONEYWELL First in Control

SAFETY TO OPERATOR AND EQUIPMENT
...against shorts up to 100,000 amps!



TYPE SAHD
Fusible only.
30—1200 amps. 240-v.—600-v.

TYPE SCHD
Fusible and non-fusible.
30—200 amps. 240-v.—600-v.

FRANK ADAM HEAVY DUTY SAFETY SWITCHES

Proven in repeated tests without a failure—dependable, positive protection against 100,000 amp. shorts for both men and equipment. In addition, every switch is pre-shipment tested under loads double the rated voltage plus 1000!

FRONT HANDLE OPERATION allows side-by-side ganging; conserves all the space wasted by side-handle switches. Type SAHD can be FLUSH or surface mounted.

QUICK-MAKE, QUICK-BREAK Shutlbrak mechanism positively prevents arcing and pitting of main contacts.

KAMKLAMP FUSE HOLDERS lock fuse immovably in place; prevent overheating and burned fuses caused by loose contacts.

Interlocking hinged doors, wide-open access to interior for easier wiring, plus a host of other features make these heavy duty safety switches the industry's finest. *Ask for new Bulletin 502.*

SINCE 1891

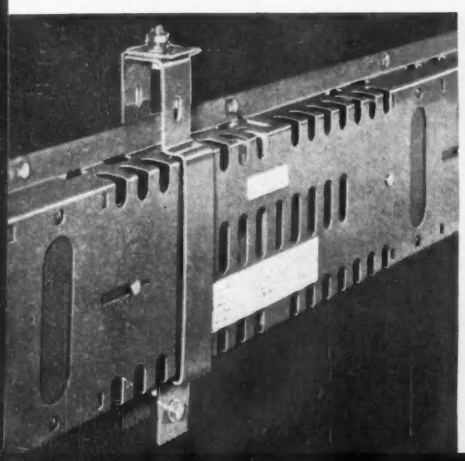
FRANK ADAM ELECTRIC COMPANY
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

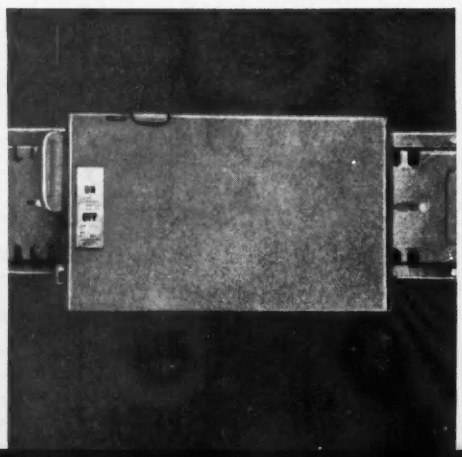
busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

1. HALF THE WEIGHT of most other ducts; selective low voltage drop; easier installation; easier maintenance . . . yet Uni-Bus costs no more! Family of six types for all industrial, commercial, laboratory and high rise building needs. Rated 100-4000 amps., 600 volts.

2. COMPLETE SAFETY, COMPLETE CONVENIENCE with Uni-Bus Plug-in devices which provide branch circuits at every 10 inches of Uni-Bus duct . . . or in stacks in the new Uni-Bus plug-in distribution centers. Patented interlocks make it impossible to touch a live part!

3. PLUG-IN POWER for distribution, motor control, and lighting panels is provided by new, flexible Uni-Bus Plug-in centers. Plug-in Trof design takes 30% less space; provides groupings of 2 to 10 locked plug-in outlets in 20 inch wide enclosures.





A new approach to in-plant power

Uni-Bus makes your entire distribution system a plug-in switchboard!

Get low voltage drop, easy installation, the ultimate in flexibility, safety and power availability... yet you pay no more!

Here's an entirely new kind of distribution system that provides all you need in accessible and flexible circuit protection right from the main disconnect to the ultimate use!

It's so safe you can't touch a live part anywhere in the system . . . so convenient you can plug in any place, any time . . . so lightweight and easy to assemble you can cut installation and maintenance time drastically.

That's not all! Better design gives better electrical performance . . . low voltage drop; no derating regardless of mounting plane.

Uni-Bus is so flexible you can revise it readily even if your plant layout changes every year. No obsolescence . . . duct, plug-ins and fittings are 100% reuseable.

Look at this list of Uni-Bus features. Don't you see a *better* answer to *your* power distribution problems?

Standard Components—Uni-Bus is a complete system featuring interchangeable parts all the way. Uni-Bus requires less than ¼ of the accessories of ordinary busway.

No Specials—Off-the-shelf lengths mean you can tailor straight runs within 2½". Exclusive flexible connectors take care of special turns and offsets.

Low Impedance—Ratings are increased through use of multiple bars scientifically spaced . . . specially insulated aluminum and copper bus bars are supported and air spaced by durable polyester glass insulators in ventilated steel enclosures.

Easy to work on—Complete safety not only protects life but also means worry-free, quicker work with less downtime for maintenance or alterations.

A system that grows—Plug-in centers grow with your needs. Plug in another standard device . . . or add another standard plug-in trof. No need to wait while somebody assembles and wires a new panelboard.

Next time you build, remodel, or expand a plant get the busway system that gives you so much more. Choose Uni-Bus . . . the complete power distribution system with complete plug-in safety, convenience, and economy.

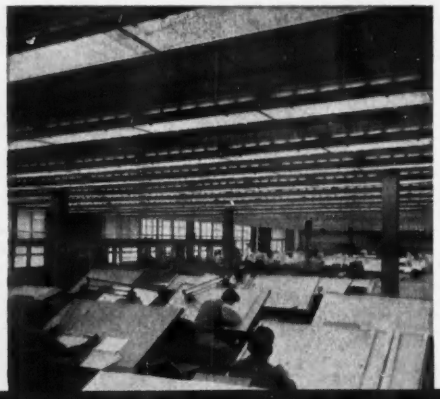
See your Cutler-Hammer distributor or representative today! Or write direct for Publ. LU-23-P241 on Uni-Bus duct systems and plug-in distribution centers.

WHAT'S NEW? ASK...

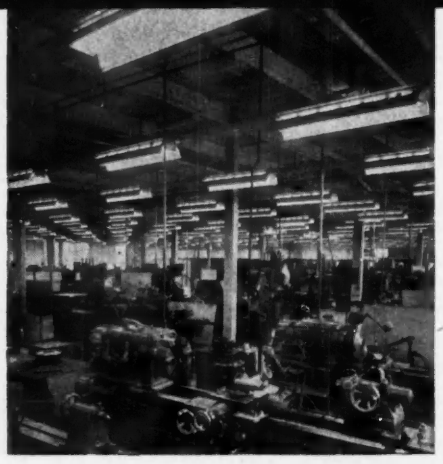
CUTLER-HAMMER

Cutler-Hammer, Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc., Cutler-Hammer International, C.A. • Associates: Cutler-Hammer, Canada, Ltd.; Cutler-Hammer, Mexicana, S.A.

WHO uses Champion Lamps?



Champion Lamps provide high-level illumination in Raytheon's Wayland, Mass., laboratory drafting room (top); Spencer Laboratory at Burlington, Mass., (center); and Wayland machine shop.



RAYTHEON uses Champion Lamps

You can judge the quality of Champion Lamps by the calibre of the companies that buy them.

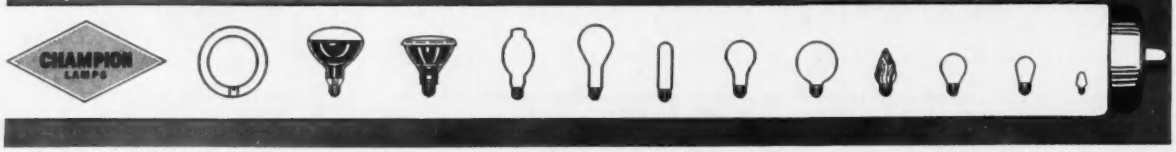
Raytheon, for instance.

One way that Raytheon maintains its own world-wide reputation for excellence is by demanding a high degree of excellence in the equipment it purchases for plant operations. If Champion Lamps didn't meet severe quality standards, thousands of them would not be illuminating Raytheon's plants and laboratories.

Specialists in Industrial Lighting Since 1900

CHAMPION LAMPS

Lynnway, Lynn, Mass. Lynn 3-2000

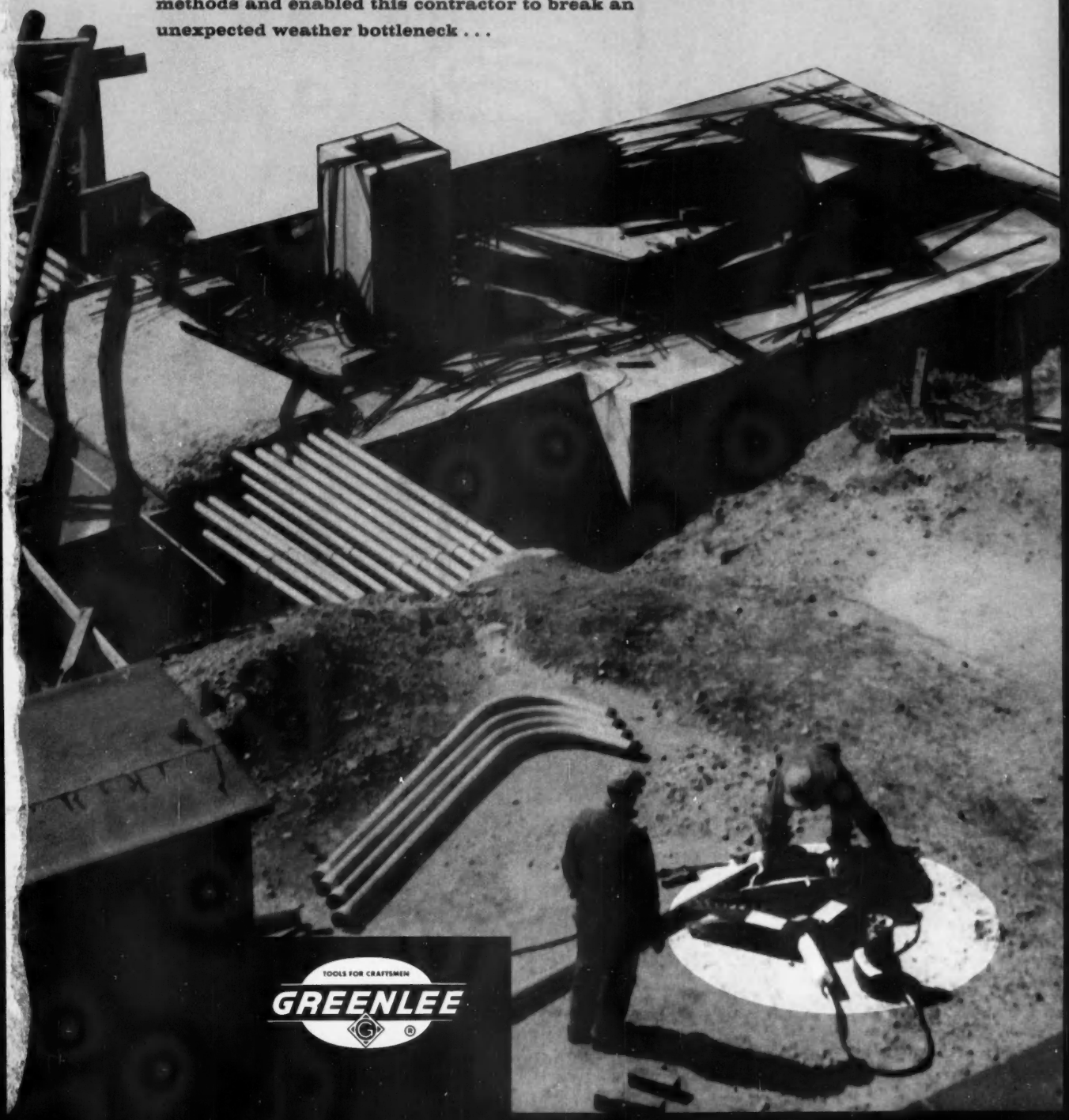


CONTRACTORS' REPORT

on Greenlee Job-Profit Tooling

"GREENLEE BENDERS SAVED US THOUSANDS OF DOLLARS IN LOST CONSTRUCTION TIME . . . and helped us meet a tough contract schedule," reports George Chiarkas, job superintendent, Nager Electric Co., Inc., Brooklyn, New York, electrical contractors for the new addition to the Jamaica Pollution Control Project on Jamaica Bay, one-half mile from New York's Idlewild airport.

Read how Greenlee Job-Profit Tooling streamlined work methods and enabled this contractor to break an unexpected weather bottleneck . . .



TOOLS FOR CRAFTSMEN

GREENLEE

®

TOOLS FOR CRAFTSMEN

GREENLEE

OUR 100th YEAR

An on-the-job report on Greenlee Job-Profit Tooling from George Chiarkas, job superintendent, Nager Electric Co., Inc.

"GREENLEE TOOLS, more than any other equipment, have helped us keep our work and cost schedules in line."

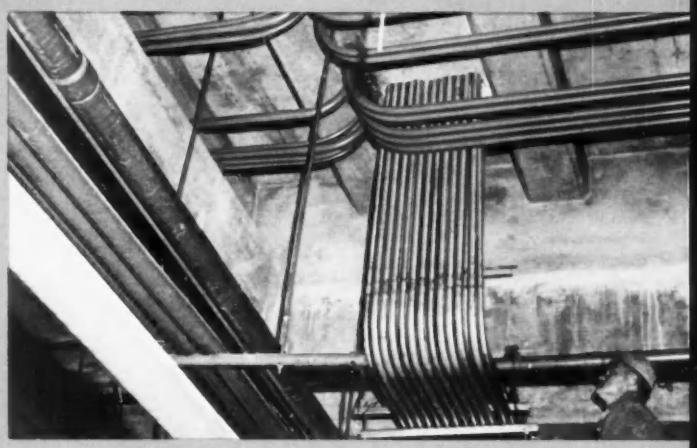
"Soon after we started this project, heavy spring rain bogged down operations and threatened to cause costly delays that easily could have thrown us far behind schedule. To break this bottleneck in a hurry, we rigged a prefab bending shop using two Greenlee 90° one-shot benders. This let us build up a supply of bends in advance of need, with a big saving in labor costs.

"We have saved in other ways with Greenlee tools . . . on maintenance in particular. Greenlee benders have been in use almost daily since we started in January, without a minute lost for repairs. This record also holds true for the Greenlee knockout punches, hydraulic power pumps, and other tools used on the job."

"With this one-shot bender (Greenlee No. 884), making a bend takes only minutes where other bending methods can take up to an hour or more. Multiply this saving in time and money by the ten carloads of conduit going into the project and you can understand why we use Greenlee benders on all our jobs."

"We use the best tools we can buy!" According to Chiarkas, "This is a rule that has always paid off for us in the long run . . . in lower costs and a better job all the way around. For example, some contractors still use hole saws to make conduit openings in outlet and junction boxes. To save time, we use a power-driven one-shot knockout punch (Greenlee No. 1732). It can be carried from place to place and is easily operated by one or two men. We don't have to drill any locating holes or use step-up punching to do the job.

"The hydraulic power pump (Greenlee No. 798-AC-SA) we use to drive this rig is the same one used with our hydraulic benders, so there is nothing extra to buy . . . and we get a substantial timesaving over hand-pump operation on both types of tools."



"Job appearance is important," Chiarkas reports, "and conduit runs that look neat and orderly are a good indication of a really professional contracting job. Once in a while we run into a new bending problem, especially on larger size conduit. Rather than waste time guessing at the correct bending procedure and run the risk of ruining the appearance of the job, we usually ask a Greenlee man for help. We rely on these people a lot for important technical bending data we can't get anywhere else and they have always been able to solve our toughest bending and tool application problems."

For complete information on other Greenlee Job-Profit Tooling, please turn page.

"Bending small diameter pipe and conduit can be done a lot of ways. We prefer to use this little hand bender (Greenlee No. 1800). It has a ratchet for easier bending, it's simpler to control than a hickey, and it handles ½", ¾", or 1" conduit. With it we can bend any length of pipe and not worry about alignment problems. When the electrician is done, he just wheels the bender along behind him to the next work area."

GET THE FACTS!

Fill out the reverse side of this postage-paid reply card and mail it today for detailed literature on Greenlee Job-Profit Tooling.

First Class
Permit No. 291
Rockford, Ill.

BUSINESS REPLY MAIL
No postage necessary if mailed in the United States.

4c Postage Will Be Paid By:

GREENLEE TOOL CO.
2034 Columbia Avenue
Rockford, Illinois

Attention: SALES DEPARTMENT

GREENLEE

GREENLEE
JOB-PROFIT
TOOLING . . .

COST CONTROL

FOR CONTRACTORS

Today, with bidding getting tighter, the contractor that is best equipped to effectively control costs usually gets the job . . . and completes it at a profit.

Many leading contractors — like Nager Electric Co., Inc., have standardized on Greenlee Job-Profit Tooling, with its time- and moneysaving features.

Your Greenlee distributor and Greenlee factory representative can help you select the exact tooling you need to control costs and assure a better return on your tool investment . . . *contact him today.*

GREENLEE TOOL CO.
2034 Columbia Avenue
Rockford, Illinois

Lightest, most powerful 4" segment bender on the market . . . the Greenlee No. 777. It weighs only 65 lb (exclusive of shoes), yet has power to spare for segment bending 1¼" through 4" steel or aluminum conduit and pipe. Also it can be used to make one-shot 90° bends ½" through 2", and thin-wall bends ¾" through 2". Fast, easy one-man operation with hand or power pump. *Bulletin E-249.*

Punch knockout openings fast for up to 5" conduit with a Greenlee No. 7646 punch driver. Punches 10-gauge metal many times faster than with wrench method. Unit drives all standard Greenlee knockout punches. *Catalog 37-E.*

First quality Greenlee bits make every job go smoother . . . faster. Power drill and hand-brace types are available in various styles, sizes, and lengths — more than 30 types in all. Power bits for ½" and larger chucks featured in hexagon shank for positive drive. *Catalog 37-H.*

Take the guesswork out of pipe bending with this new pocket-size calculator. Use it with Greenlee Models 880M2, 883, 884, and 777 hydraulic benders to quickly find all data needed to lay out and bend offsets, one-shot 90° bends, "legs" or "stub-ups" in ½ to 4" conduit or pipe. Price $1.00 . . . order from Greenlee Tool Co., Rockford, Illinois.

Mail this postage-paid reply card today.

Please send me more information on the following Greenlee tools:

- ☐ Hydraulic benders
- ☐ Hand benders
- ☐ Knockout punches and drivers
- ☐ Cable pullers
- ☐ Hand and power bits
- ☐ "Little Kickers" for 1/2" or 3/4" E.M.T.
- ☐ Other tools_____
- ☐ Please have a representative call to discuss Greenlee Job-Profit Tooling.

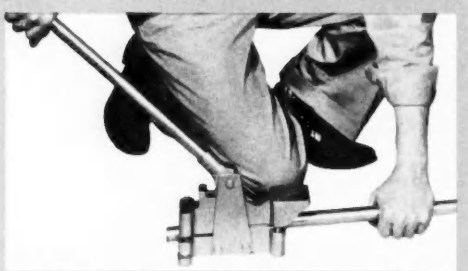
Name_____

Title_____

Company_____

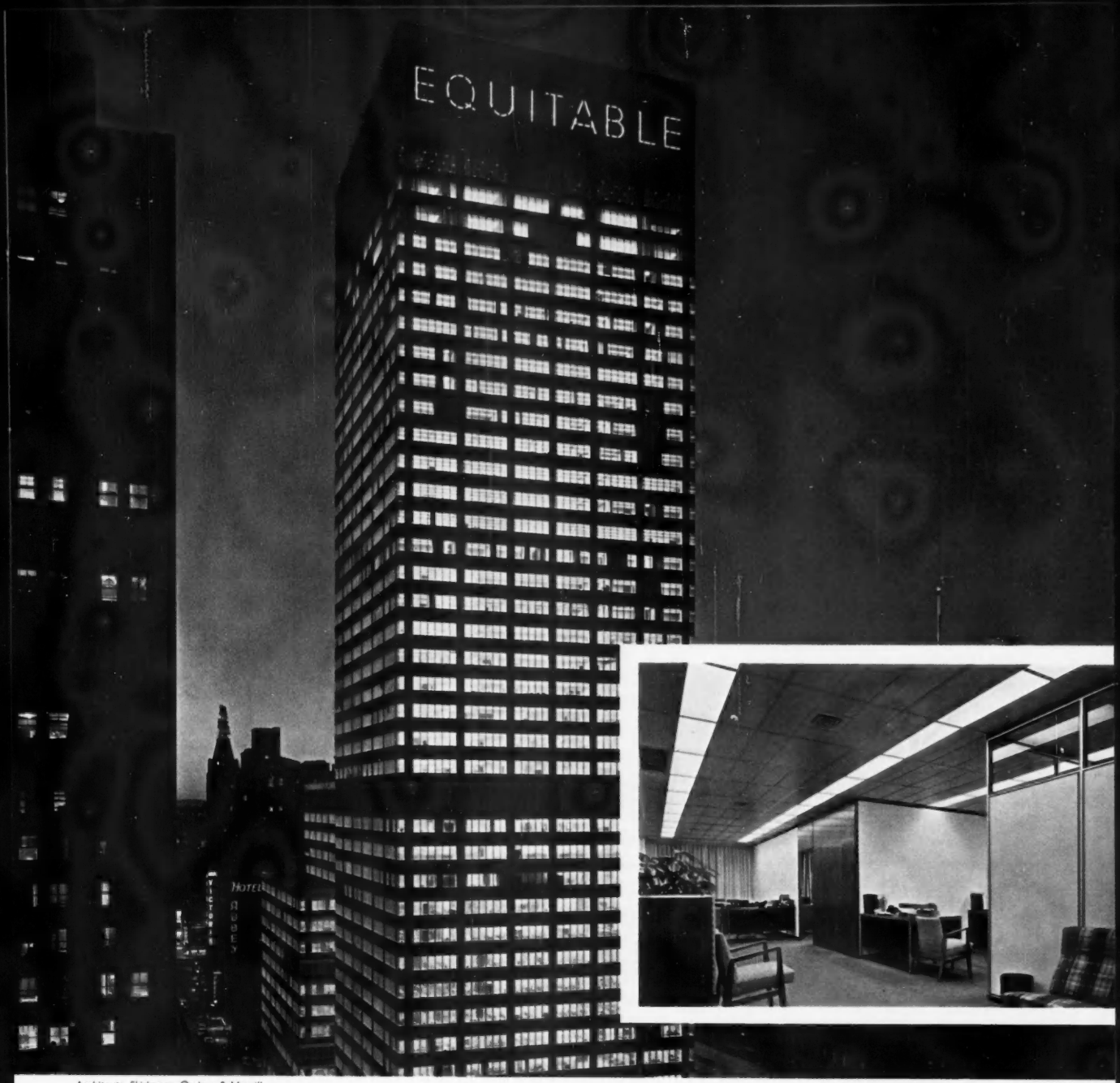
Address_____

City_____ Zone_____ State_____



Bend offsets in E.M.T. in just two seconds with a Greenlee "Little Kicker." It forms perfect offsets where ¾" or ½" E.M.T. enters switch boxes or other outlets. Tool makes this standard offset *in one shot* — saves up to 12¢ in material *per connection* and cuts hours on every job. Two models: 1810 for ½" E.M.T.; 1811 for ¾" E.M.T. *Bulletin E-320.*

I-434-E Printed in U.S.A.



Architects: Skidmore, Owings & Merrill

Lighting for prestige buildings— Plexiglas

At the towering new Equitable Life Assurance Society building in midtown Manhattan, nearly 43,000 fluorescent luminaires are used to provide lighting of the highest quality. Each is equipped with a control lens injection molded of crystal-clear PLEXIGLAS® acrylic plastic.

The lenses are precisely designed optical elements that direct a high level of light to the areas where it is required, and at the same time minimize the surface brightness of the lenses as seen from normal viewing angles. In addition, because they are made of PLEXIGLAS the lenses are strong and rigid . . . and will remain free of discoloration through years of use.

We will be pleased to send you literature on PLEXIGLAS as a lighting material, and the names of manufacturers whose equipment includes lenses . . . for lighting that stands out and stands up.

ROHM & HAAS

PHILADELPHIA 5, PA.

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.

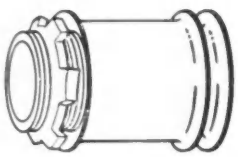
In Canada: *Rohm & Haas Company of Canada, Ltd., West Hill, Ontario*

TIME SAVERS FOR YOUR UNITS MANUAL

No. 2

• GUTTER CONNECTORS

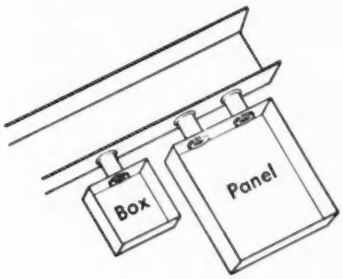
STRAIGHT (3 PIECES) STEEL



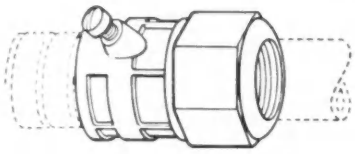
Cat. No.	Size
M 45-20	½"
M 45-21	¾"
M 45-22	1"
M 45-23	1¼"
M 45-24	1½"
M 45-25	2"

Gutter Connectors are designed to install rapidly—no locknuts are needed inside trough.

The Gutter Connectors maintain perfect spacing of units automatically.



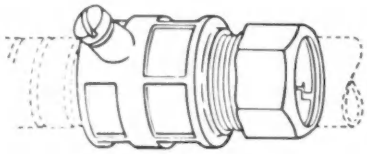
• COMBINATION COUPLINGS



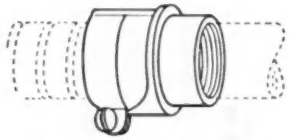
Flexible Conduit to Rigid Pressure Cast

Makes transition from one system to another quickly and at low cost.

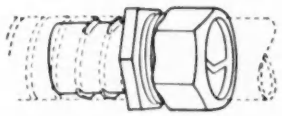
Eliminates the special on-the-job nipple slings that are never entirely satisfactory. Connections made are shorter in length. Saves space. Fishes easy, only one screw to set.



Flexible Conduit to EMT Pressure Cast, Steel Nut

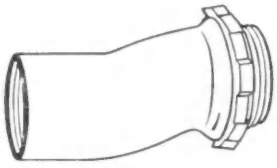


Flexible Conduit to Rigid Malleable Iron



Flexible Conduit to EMT Pressure Cast, Steel Nut

• RIGID CONDUIT OFFSET CONNECTOR



Cat. No.	Size
M 47-20	½"
M 47-21	¾"
M 47-22	1"

Fast, screws on Conduit and provides accurate entrance into box. Only one locknut needed—inside box. Wire fishes easy. No Conduit bending for offset.

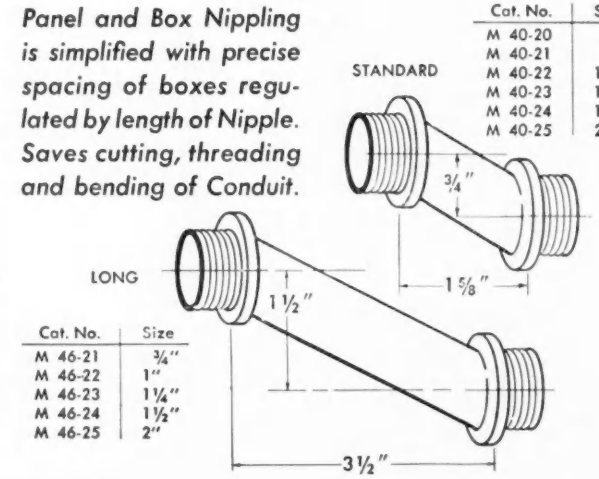
STEEL CITY BRINGS YOU
Better Values in Electrical Fittings

Write for Conduit Fittings Catalog

• CONDUIT OFFSET NIPPLES

Panel and Box Nippling is simplified with precise spacing of boxes regulated by length of Nipple. Saves cutting, threading and bending of Conduit.

Cat. No.	Size
M 40-20	½"
M 40-21	¾"
M 40-22	1"
M 40-23	1¼"
M 40-24	1½"
M 40-25	2"



Cat. No.	Size
M 46-21	¾"
M 46-22	1"
M 46-23	1¼"
M 46-24	1½"
M 46-25	2"

Steel City
PITTSBURGH 33, PA

Steel City Electric Co. is a Construction Materials Division of **MARTIN MARIETTA**

a down-to-earth talk about MOTOR STARTERS

ours is small!
ours is smaller!
ours is smallest!
ours lasts and lasts!
ours lasts and lasts and lasts!
ours lasts forever!
ours installs faster!
ours is most accessible!
ours is most versatile!
ours is easier to inspect and maintain!
ours doesn't have to be maintained!

CONFUSING!... isn't it?

Let's face it—there isn't a starter made with every feature you want. Design a starter specifically for easy disassembly, easy modification, small size or what-have-you—something has to give.

Square D's answer is balanced design—the design which gives the most of all the features while sacrificing the least of any one.

Square D starters have pressure wire connectors, plenty of knockouts, easy-to-read terminal markings, front-connected leads. There's provision for adding pilot lights, push buttons; an adequate number of electrical interlocks, and other field modifications. Square D starters are small, but not to the knuckle-scraping extreme. They're rugged. They're easy to install, inspect—and maintain.

One claim that won't create confusion (because it's a Square D starter "exclusive") is the greater motor protection afforded by the one-piece construction of Square D overload relays. And after all, isn't that what you want most from any starter?

write for Bulletin SM-293 on Class 8536 Starters
Square D Company, Dept. SA, 4041 North Richards Street
Milwaukee 12, Wisconsin

SQUARE D COMPANY

wherever electricity is distributed and controlled

Installation by Consolidated Edison of N.Y.

Here's where cable reliability really counts...

Utility power systems need extra protection against the inconvenience and high cost of electrical failures. Circlesheath type RR power cable gives that extra protection. Maximum performance is built into Circle cable through expert knowledge of compounding techniques and absolute quality control. It surpasses all IPCEA-NEMA specifications for ozone resistance, long term stability, dielectric strength and other important cable requirements.

Circlesheath type RR power cable is available from 600 to 15,000 volts. For maximum reliability specify Circle on your next cable installation.

CIRCLE WIRE & CABLE CORP.
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

WEAVER

BRONZE GROUND CLAMPS

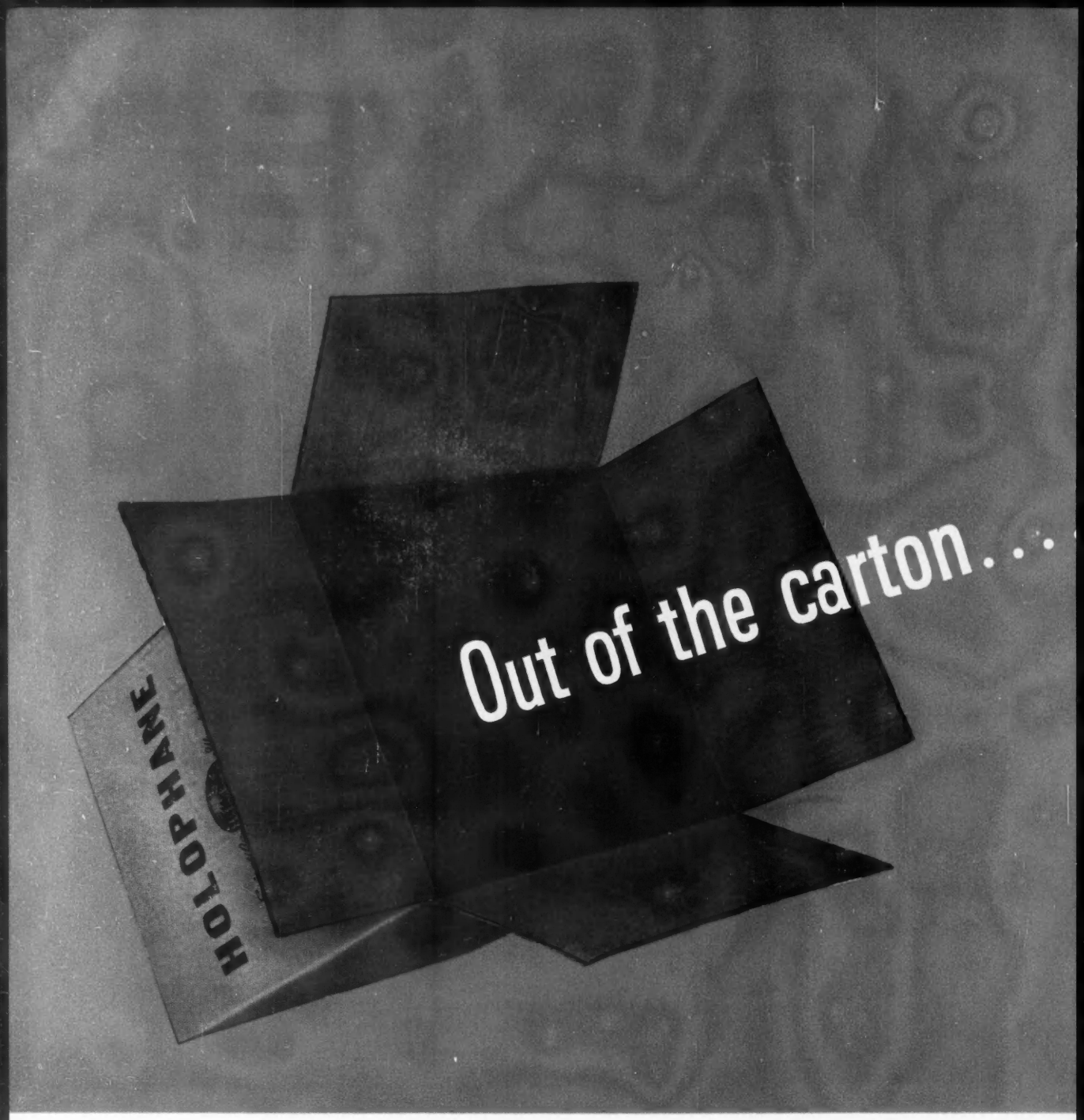
. . . Easy to Install,
Last Longer

Compare WEAVER Bronze Ground Clamps with any others. WEAVER Clamps are bigger, heavier and more rugged. Extra metal at pressure points gives maximum strength . . . increases conductivity. The all-bronze construction with heavily cadmium-plated screws prevents rust and corrosion . . . assures safe, permanent grounding. Swinging top eliminates loose parts to assemble and cuts down installation time. Only 3 types cover every grounding job. Sizes for ¼" through 4" copper or galvanized pipe.

Ask your Electrical Wholesaler For
Weaver Bronze Ground Clamps

J. A. WEAVER Company

2110 Howard Street • St. Louis 6, Mo. • GArfield 1-6336



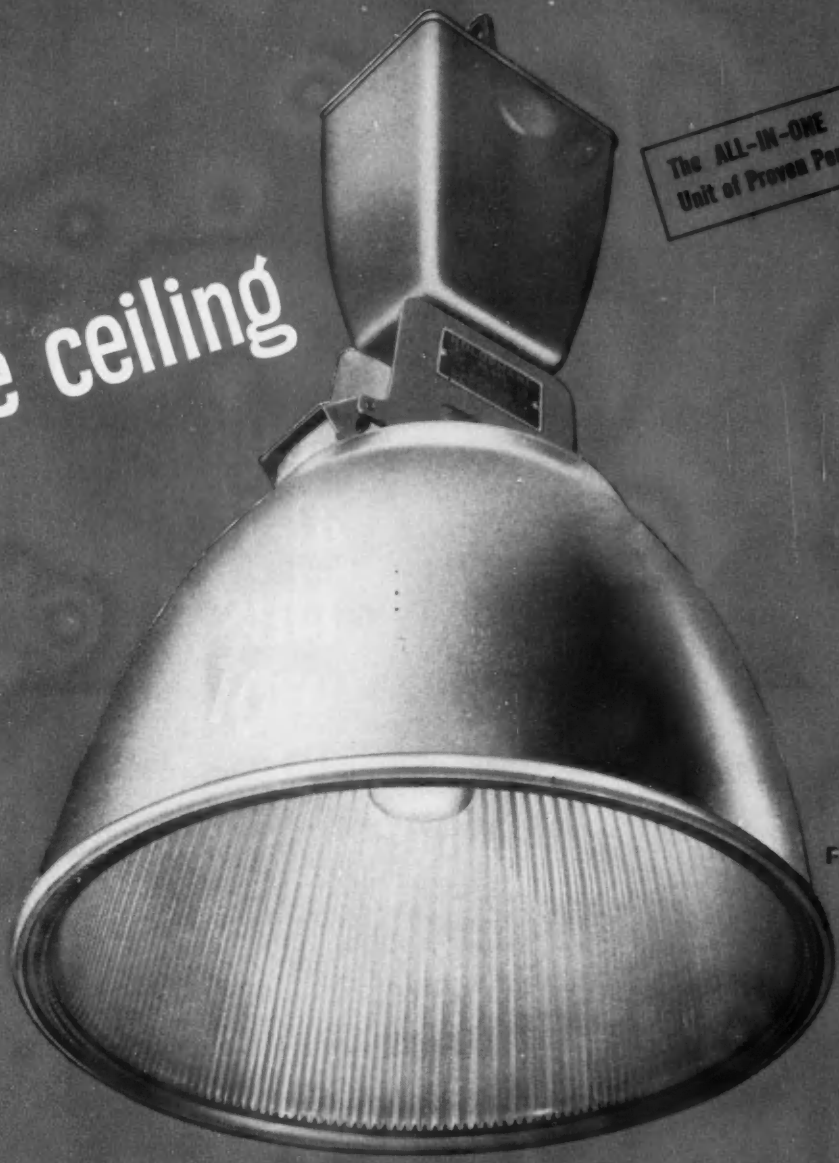
HOLOPHANE contributes another important advance in Effective Economical Lighting

Prismpack

The Only Mercury Luminaire that is Installed Instantly

...onto the ceiling

The ALL-IN-ONE Mercury Unit of Proven Performance



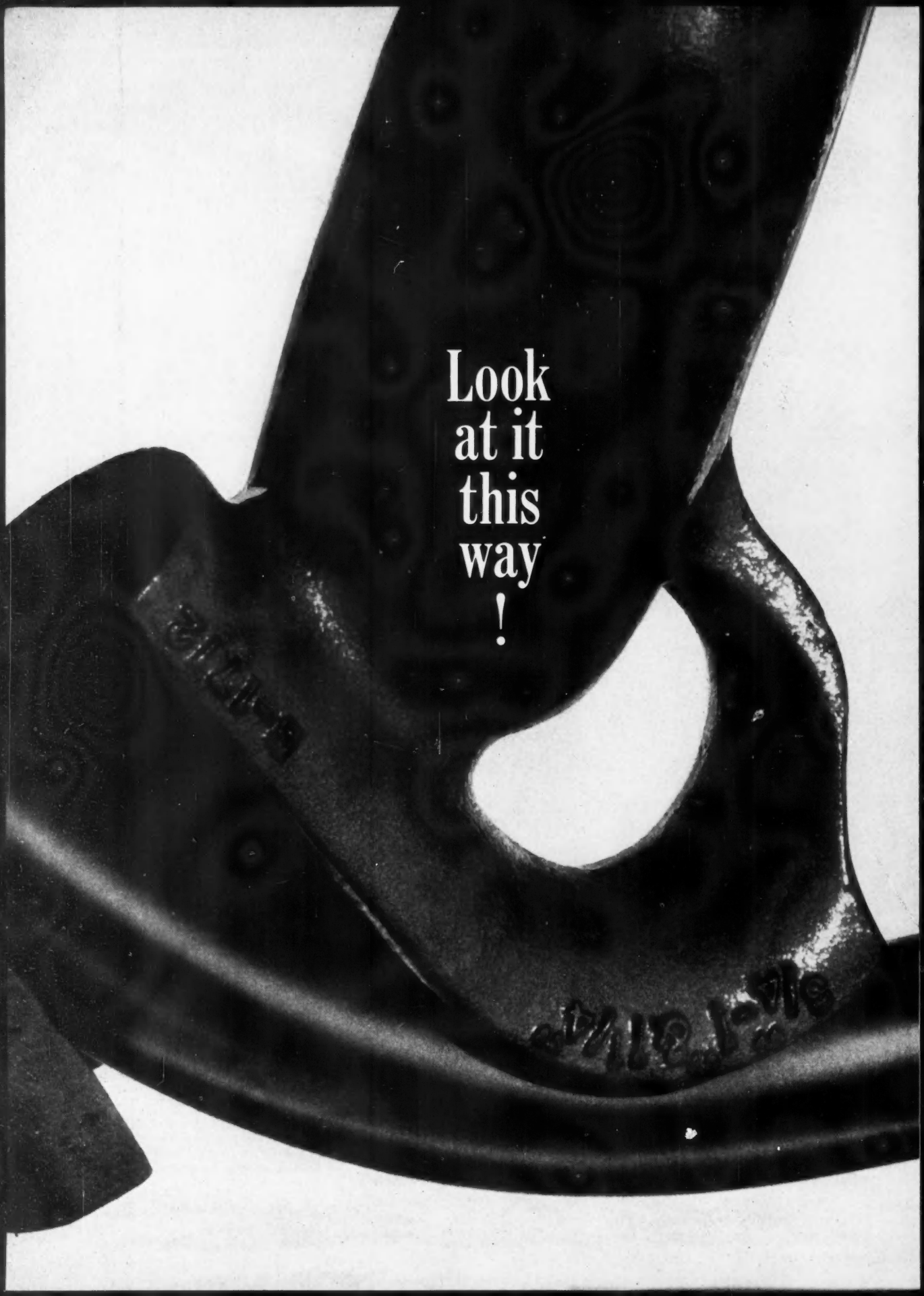
PRISMPACK

Transformer design developed in cooperation with SOLA

Gone are the complications of ballast, fixture, lamp and holding devices... For here is Holophane's **PRISMPACK**—an all-in-one luminaire, designed to simplify the installation of mercury lighting with a procedure as easy as A,B,C... A: Lift the luminaire out of the carton... B: Hang it on the ceiling... C: Connect two line wires... And in a matter of minutes, the unit is ready for operation!

This LOBAY® luminaire, with its integrated ballast mounted in a specially designed housing, has many fundamental advantages. The prismatic reflector delivers the highest utilization of light; it provides a sharp cut off (above 45°) with a wide spread of illumination to vital areas; it shields the light source, minimizes glare; open top and bottom permits airflow to keep unit clean. Moreover the unit is economical to install and maintain... From every viewpoint it is superior to any mercury luminaire ever offered in the industrial and institutional lighting fields... Get all the facts—write for engineering data on **PRISMPACK.**

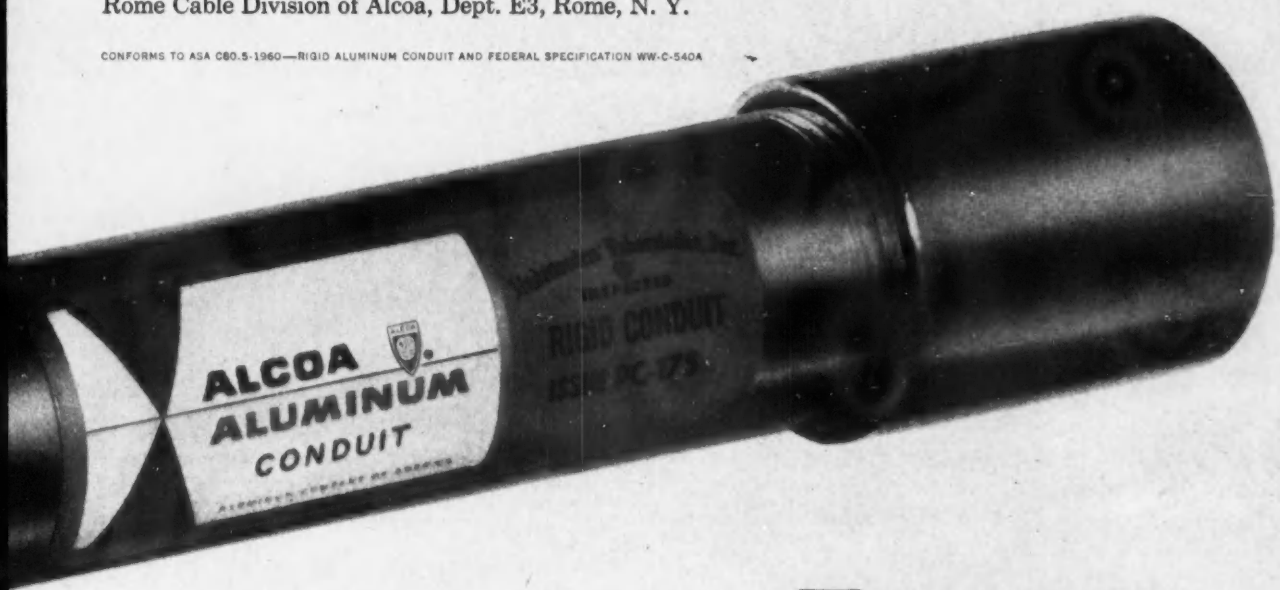
HOLOPHANE COMPANY Inc.
Lighting Authorities Since 1898
342 Madison Ave., New York 17, N.Y.
The Holophane Co., Ltd., 418 Kipling Ave. So., Toronto 18, Ont.


Look
at it
this
way
!

No other type of conduit is so easy to bend, costs so little to install

With a hickey or an EMT bender (one size larger), Alcoa *aluminum* electrical rigid conduit is easier to bend. And this is only one of the ways aluminum conduit saves installation time and money. It's also much easier to cut. Easier to thread, using a sharp regular die. Easier to carry and position, because of its lighter weight. Its smooth, specially-lubricated interior makes cable pulling easier. □ Alcoa aluminum rigid conduit makes a better installation as well as a more economical one. It is naturally corrosion-resistant: needs no painting or other protection. It's non-magnetic. Non-sparking. □ Discover all the advantages of competitively-priced Alcoa aluminum rigid conduit: ask your Alcoa-Rome representative or distributor for the facts and figures. Or write to Rome Cable Division of Alcoa, Dept. E3, Rome, N. Y.

CONFORMS TO ASA C80.5-1960—RIGID ALUMINUM CONDUIT AND FEDERAL SPECIFICATION WW-C-540A



ALCOA
ROME CABLE
DIVISION

This seven-room brick ranch home features prewiring for the Bell Chime and for Home Interphone, the Bell System's home communications service.

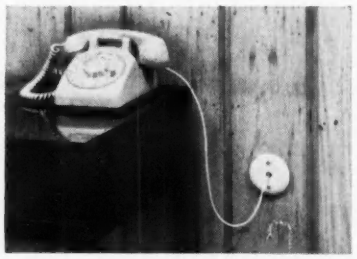
In Indianapolis, Indiana, this house sells for $26,500

(*"...and concealed telephone wiring helps sell it for us," says builder Leon Pedigo*)

"My customers know the value of concealed telephone wiring," says Leon Pedigo of Pedigo and Young, Builders. "I find that people know that telephone prewiring helps preserve the beauty of the home, and it adds to resale value.

"It's so easy to give the customer this extra convenience; the Telephone Company does the work quickly while the home is going up. Concealed telephone wiring is one more luxury feature to please the customer. And it's a good one."

When building on speculation, Leon Pedigo includes color telephones as part of the decor, and advertises the fact that the house is prewired for telephones.



Your Bell Telephone Business Office will help telephone-plan your homes. For details on home installations, see Sweet's Light Construction File, 11c/Be. For commercial installations, Sweet's Architectural File, 33a/Be.

BELL TELEPHONE SYSTEM

NEW General Electric QHT Transformers

CLAMP-TYPE CONNECTORS

ACCOMMODATE ALUMINUM OR COPPER CABLE

•

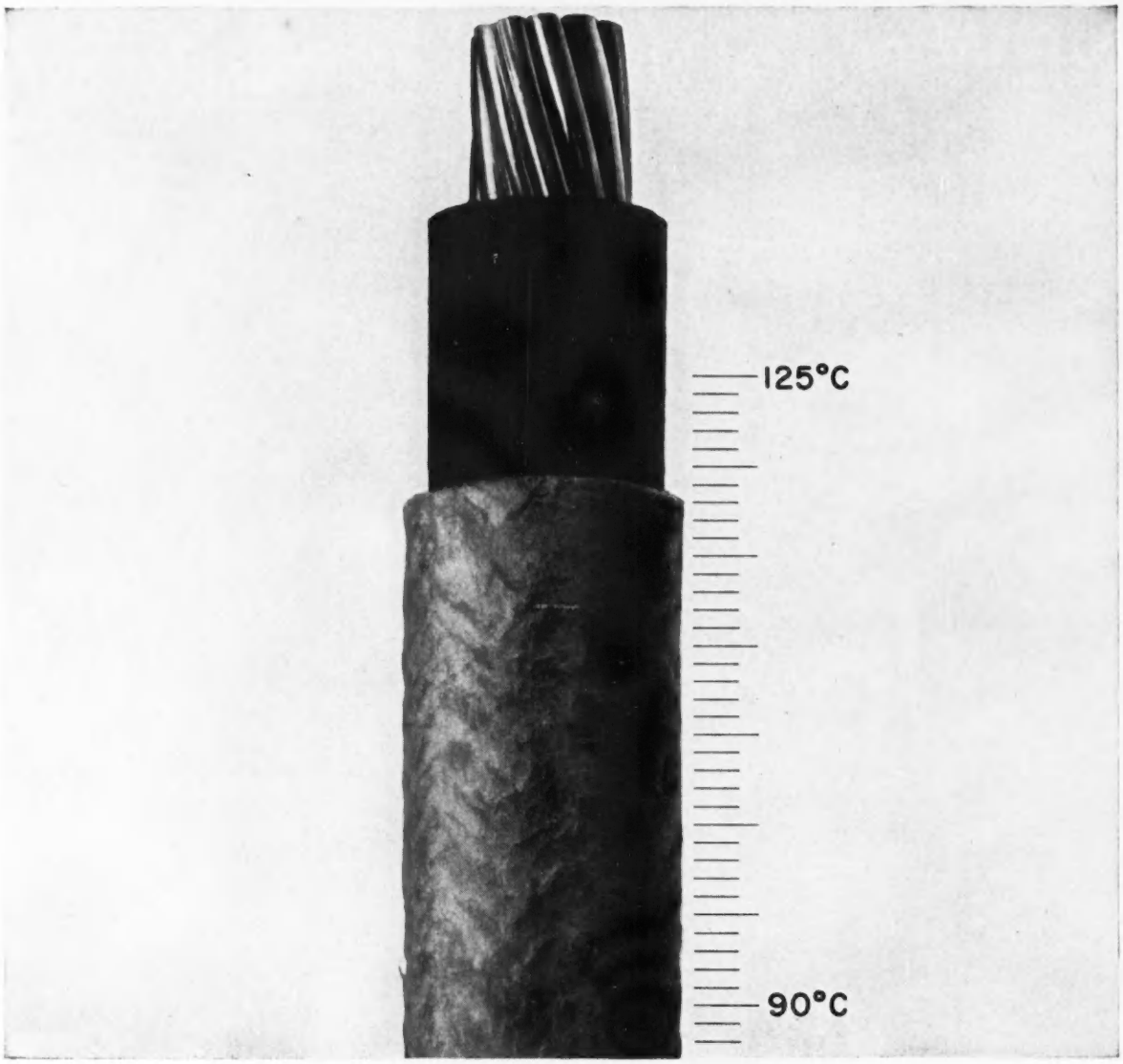
SPEED HOOK-UP

IT TAKES JUST MINUTES to make both incoming and low-voltage connections in new QHT Type H transformers. Just strip the cable — either copper or aluminum can be used. Insert in clamp-type connector. Tighten nut. All connections are up front — completely accessible during installation and later. The need for space-consuming access aisles is eliminated. SAVE TIME AND VALUABLE FLOOR SPACE . . . USE NEW GENERAL ELECTRIC QHT DRY-TYPE TRANSFORMERS. Get all the facts from your nearby G-E Sales Office or distributor. Or write Section 411-24, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ACCENT ON VALUE



Now, 600V Anaconda Hot-Spot ...the first butyl cable specifically engineered for the 90C–125C range

Before Hot-Spot was developed, you had only two choices in the 90C-125C range: a cable that was too good for the job (which cost you extra) or a cable that wasn't good enough (and left you open for expensive call-backs). No longer! With Hot-Spot you get a cable that's exactly tailored to the job–in cost as well as performance.

Far less cost. Rated 125C, Hot-Spot butyl gives you everything you want in a high-temperature insulation—*but without the high price tag.* You get high heat resistance as well as rubber flexibility and high cut- and moisture-resistance.

It outlasts ordinary cables 3 to 1. Because it doesn't become brittle or lose its high tensile strength in extended high temperature operations, your replacement costs go down. And Hot-Spot will outlast other high temperature cables because of its superior resistance to moisture, especially important during shutdowns.

Its diameter is no greater than most standard 90C cables. Therefore, if hot spots are plaguing your present system, you can use Hot-Spot cables as a replacement—without the high cost of new conduit and fixtures—another cost-saving advantage.

Hot-Spot is the ideal cost-saving 600V cable for dozens of hot and hot-wet applications—in power plants, steel mills, petroleum refineries, tire and rubber mills, ceramic plants and cement plants, to name just a few. It's available in standard 600 volt power, control, and portable cable constructions.

See for yourself. For complete technical information and lab reports, write for Technical Bulletin WC-6123, Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York. 62277C

ASK THE MAN FROM
ANACONDA®
ABOUT HOT-SPOT

HANDIER THAN AN EXTRA HAND — that's Slipknot's exclusive, permanent plastic cutter-and-case — yours at no extra cost! This new tool saves time, tape and temper — and keeps your favorite tape clean and ready, whatever the job!

NOW... No. 7 SLIPKNOT
PLASTIC ELECTRICAL TAPE ...

ALWAYS CLEAN

in the NEW **FLIP-n-CUT** pat. pending

INSTANT TAPE DISPENSER

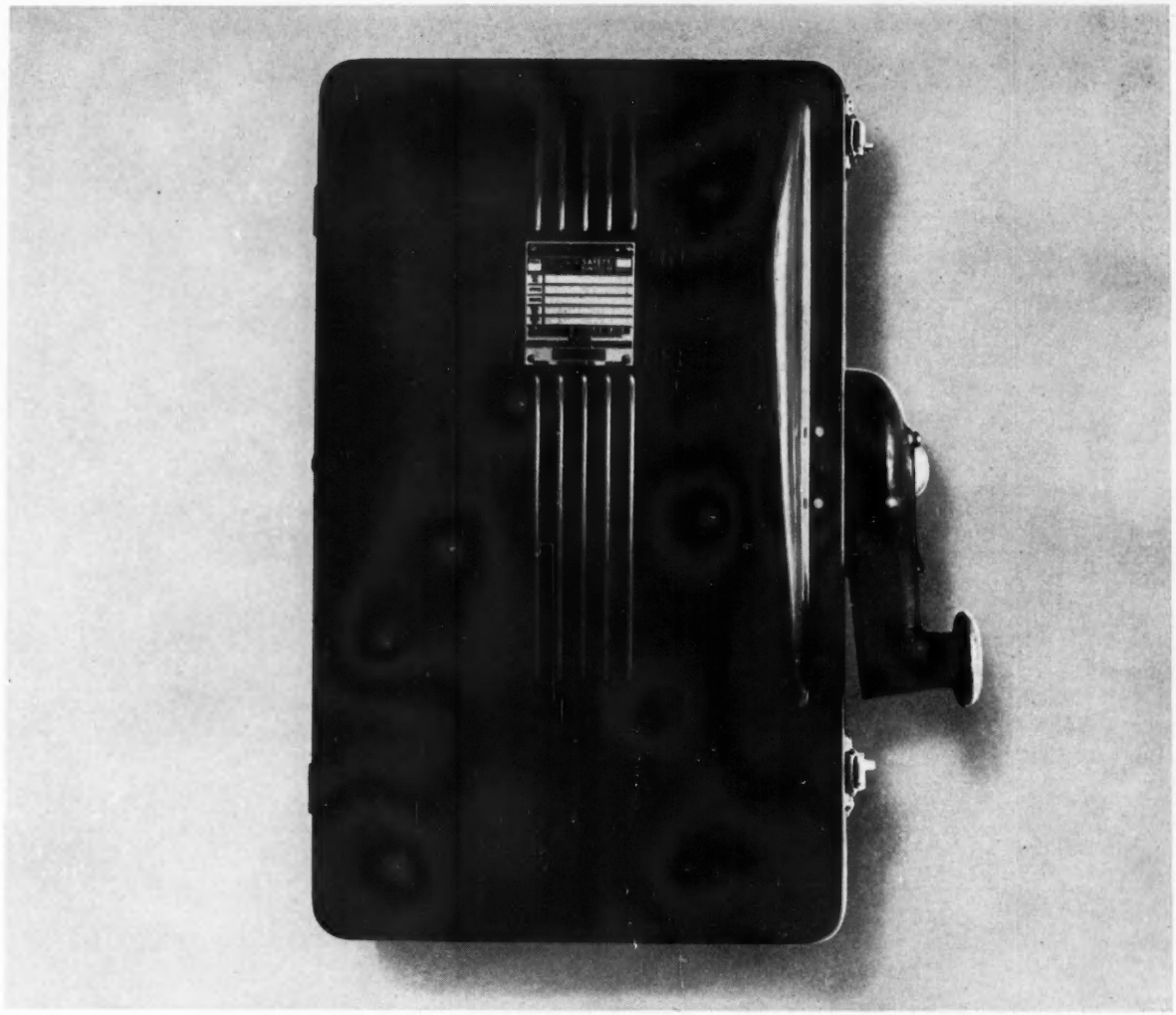
FREE... WITH EACH 66' ROLL

PLYMOUTH RUBBER COMPANY, INC.

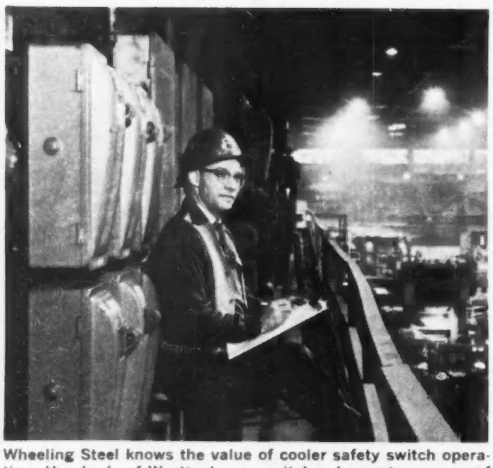
QUALITY SINCE 1896 **CANTON, MASSACHUSETTS**

TAPES BY
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS
PLYMOUTH RUBBER COMPANY, INC.

FL-3



coolest



Wheeling Steel knows the value of cooler safety switch operation. Hundreds of Westinghouse switches have given years of trouble-free performance at their Steubenville, Ohio, plant.

Cool switches last much longer, and Westinghouse makes the coolest safety switch you can find.

Take the contact area, for instance, where most heat is produced. An exclusive Westinghouse design has completely eliminated arcs from the contact area. Burning and beading don't exist there. Contacts last longer.

The De-ion arc quencher reduces heat by snuffing out arcs quickly. Joints produce heat, so Westinghouse eliminates joints with one-piece copper construction. Heat is reduced, and conductivity is improved.

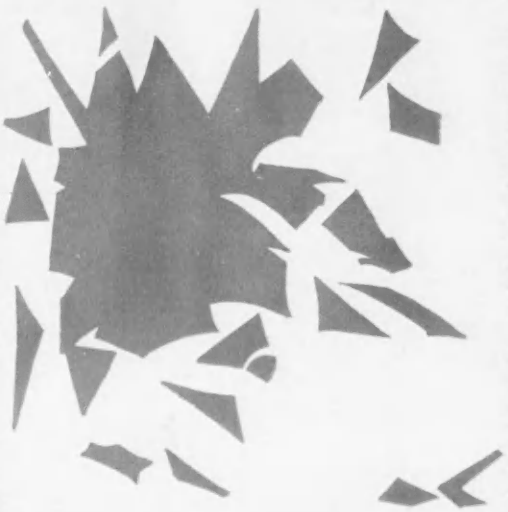
Tin-plating of copper parts further reduces both heating and wear by providing lubrication, and corrosion resistance. These features help make Westinghouse the best buy in safety switches. Ask your Westinghouse representative for complete details, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's* **Westinghouse**

J-30341

First used on Cape Canaveral...Pyle-National introduces the first and *only* Class I, Group B, 500 Watt Quartz-Iodine Floodlight. For use primarily in locations containing hydrogen, this new floodlight is weather resistant and raintight, has heat and impact resisting plate glass face, universal adjustment, exclusive reflector design and compact size. The quality of Quartz-Iodine lamps are ideal where correct color rendition is essential to TV pick-up.

THE ONLY GROUP B

EXPLOSION-PROOF



EXPLOSION-PROOF

CLASS I FLOODLIGHT

Pyle-National offers the complete line of both Group B and general explosion-proof lighting and electrical equipment. Write for Pylet catalog information.

THE PYLE-NATIONAL COMPANY, 1344 N. KOSTNER AVE., CHICAGO 51, ILLINOIS • ALSO MANUFACTURED IN CANADA BY: PYLE-NATIONAL (CANADA) LTD., CLARKSON, ONT.

THE PYLE-NATIONAL COMPANY

Washington National Airport, Washington, D.C., 1939.

...and hasn't been heard from since

That's only 23 years. Some of our installations go back as much as *60 years* and "haven't been heard from since." With more miles in use than any other conduit, Orangeburg Brand Fibre Conduit has proved itself job by job, time after time. No wonder it's the sought-after-brand for every application.

We introduced fibre conduit in 1893, and it was a superior product then. Over the years we've steadily improved it... with such innovations as fast-assembling C.A. (coupling attached) Conduit and klean-kote (for cleaner handling). As a result, Orangeburg Brand Fibre Conduit has maintained its superiority, retained its place as the unquestioned leader in its field. So ask for—and make sure you get—*genuine* Orangeburg Brand Fibre Conduit.

KLEAN-KOTE*

ORANGEBURG®

BRAND

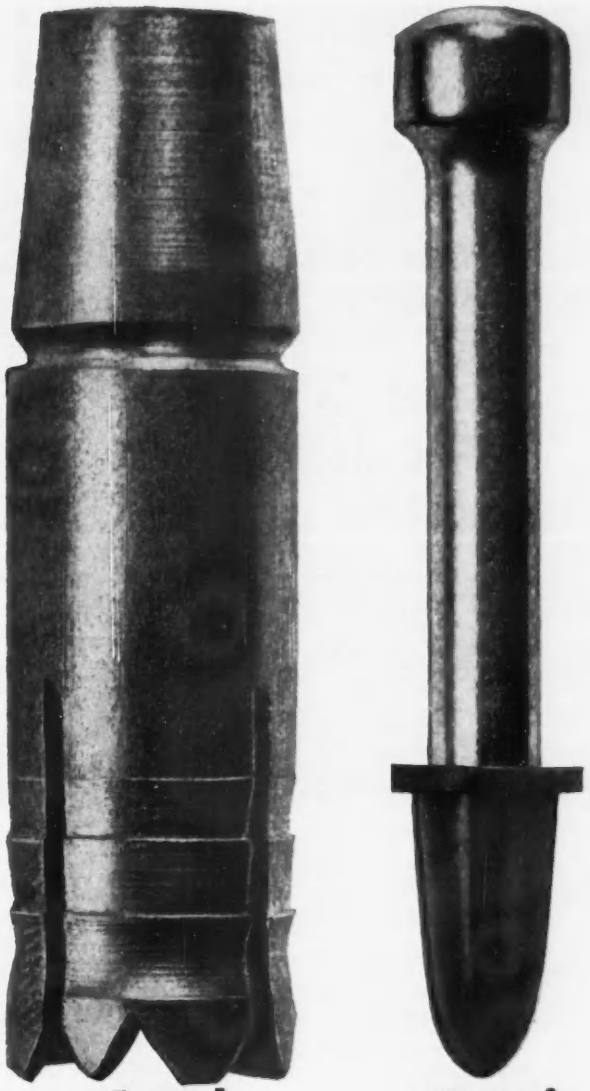
FIBRE CONDUIT

FLINTKOTE®

*KLEAN-KOTE IS A TRADE-MARK, U. S. PATENT APPLIED FOR.

Orangeburg Klean-Kote is distributed by Graybar Electric Company and General Electric Supply Company with Branches and Stocks in Principal Cities.

Orangeburg Manufacturing Co., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products



The one on the right costs less. Honestly.

A self-drilling anchor (with bolt) costs about 24% less than a Ramset drive pin (with powder charge).

If you're collecting fasteners, buy anchors. They're cheaper.

But if you're fastening metal to concrete, there's an added cost.

Labor.

The anchor can be fastened in about 5 minutes. Includes layout time, drilling steel, drilling concrete, setting anchor, tightening bolt.

Labor cost: 25¢.

The drive pin goes into a Ramset powder-actuated tool. Fastens in 30 seconds. With greater holding power.

Labor cost: 2½¢.

In place, the self-drilling anchor costs 38¢. The Ramset powder-driven pin, less than 20¢. A big difference.

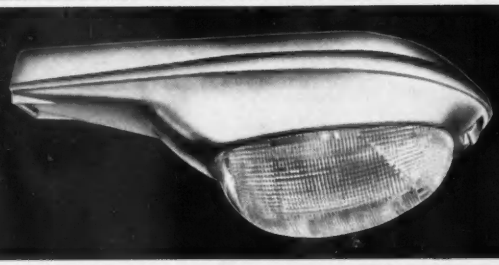
An even bigger difference with thicker steel, denser concrete or less accessible work.

You can count on at least a 47% saving with our powder-actuated fastenings. Be nice to cut all your other costs that drastically, wouldn't it?

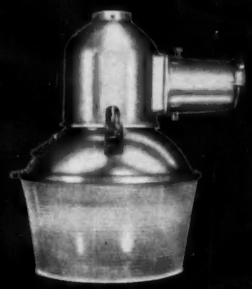
Ramset tools and fasteners are available through your Ramset dealer, listed in the Yellow Pages, under "Tools."

Ramset WINCHESTER-WESTERN DIVISION **Olin**
285-G Winchester Avenue, New Haven 4, Conn.

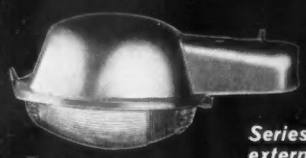
Series 2700 Superoval uses 700- or 1000-watt mercury lamps. Mounts on any standard poles now in use.



Series 2600 Unitized Endoval with built-in ballasting uses 250- or 400-watt mercury lamps.



Series 2320 Star-Lux OBR uses mercury lamps up to 250 watts or incandescent lamps up to 6,000 lumens. Open bottom refractor, choice of top- or side-mounting heads.



Series 2500 Urbanoval for external ballasting uses 100-, 175-, or 250-watt mercury lamps.

Series 2500 Unitized Urbanoval with built-in ballasting uses 100-, 175-, or 250-watt mercury lamps.

From superhighways to country roads, Revere lets you choose the luminaire to do the job best

Revere's family of street lighting luminaires includes models for every application. From rural streets to high-intensity lighting for wide, busy city streets, you can choose an attractive, modern Revere luminaire that will do the job best.

With Revere luminaires, you can select the luminaire style and lamp type to provide the amount of light desired. Many Revere luminaires are designed for efficient, comfortable lighting with either incandescent or mercury lamps. You can select the reflector and refractor combination to provide the A.S.A.-I.E.S. distribution desired. You can select many units with or without built-in ballast components and adaptor for photoelectric control. And you can select the mounting arrangement that meets the job requirements. This wide choice of luminaires and optional features gives you the combination to do the job the best possible way.

For complete information on Revere incandescent and mercury street lighting luminaires, write for Revere's street lighting catalog.

Revere® OUTDOOR LIGHTING EQUIPMENT

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois
(In Suburban Niles) Long Distance Phone: Area Code 312 Niles 7-6060
Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles

RVR-1-208

WIREMOLD® ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

JULY 1962

ELECTRIC ACCOUNTING UNITS ..... FIRST PAGE
CODE COMMENTS ..... FIRST PAGE
NOTEWORTHY ..... THIRD PAGE
WORTH READING ..... THIRD PAGE
PRODUCT OF THE MONTH ..... THIRD PAGE
PRACTICAL TIPS ..... THIRD PAGE
ENGINEERED SPECIALS ..... FOURTH PAGE
QUIZ CORNER ..... FOURTH PAGE
COUPON FOR FREE ITEMS ..... FOURTH PAGE

Electric Accounting Units Installed with Raceway

New, simplified installation technique uses surface wiring systems for power and outlets

Installation of electrical accounting machines in existing structures looms as one of the biggest potentials for the contractor willing to carefully plan his work.

According to one estimate, computers became a billion dollar industry last year, with the largest percentage of installations going into existing buildings. It is believed that the use of this type of equipment will continue to expand over the next several years.

With growing frequency, engineers and contractors are turning to surface wiring systems to carry the conductors and supply the receptacles necessary to a properly installed accounting machine setup.

In one typical installation, a second-floor storage area was converted to the electric accounting department. Three sections were set up: programming, accounting, and EDP.

It was decided that a subfeeder system of Wiremold 3000 would supply the needed capacity and at the same time provide easy accessibility to the conductors in the event of a breakdown.

continued on second page

ELECTRIC ACCOUNTING machines were installed in this converted storage area by using surface wiring systems to provide both power and receptacles.

Code Comments

Grounding Raceways

Q. *I've heard that when using Wiremold or Plugmold a separate, extra grounding wire must be run to ground the system. Is this true?*

A. All Wiremold connections are so designed that electrical continuity is assured as long as the raceway and fittings are joined in the intended manner. See Section 300-10 of the Code.

Upgrading Lighting Loads

Q. *Does the National Electrical Code suggest upgrading the general lighting loads (unit load per sq. ft. watts) as listed in Table 220-2(a)?*

A. Yes. Article 220-2(a) (General Lighting Load) suggests:

"(1) In Listed Occupancies. In the occupancies listed in Table 220-2(a), a load of not less than the unit load specified shall be included for each square foot of floor area. . .

"The unit values herein are based on minimum load conditions and 100 per cent power factor, and may not provide sufficient capacity for the installation contemplated.

"In view of the trend toward higher intensity lighting systems and increased loads due to more general use of fixed and portable appliances, each installation should be considered as to the load likely to be imposed and the capacity increased to insure safe operation."

WIREMOLD®

Advertisement

Electric Accounting Units *continued from first page*

From a panel box outside the room the 100-amp., 220-v., 3-wire, single-phase service was brought up in a run of 3000 to near-ceiling height, nippled through the wall with armored cable, and run in another length of 3000 inside the room. This was done on two sides of the perimeter.

Branch circuits, a total of 10 for the three areas, were tapped off the subfeeder, run down behind the paneling and back-fed to the Plugmold® runs. Conductors for the branch circuits were No. 12 TW wire.

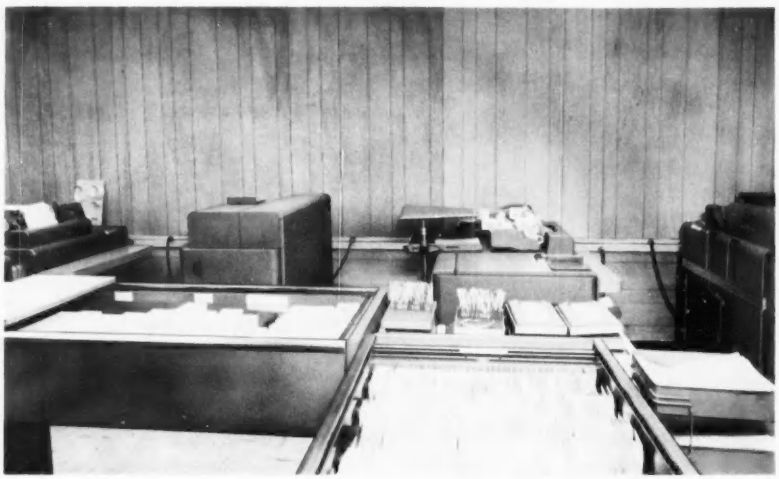
In the electric accounting area, three runs of Snapicoil® were used to feed one run of Plugmold 2000 and one of Plugmold 2200 Special. This latter strip was provided with staggered hole cut covers with the holes on two levels. Grounding, alternately-wired outlets on 30-in. centers were used in all cases. A total of 6 circuits of 20-amp., 110-v. each was provided for this area, assuring an ample factor for future use as recommended by the manufacturer.

Presently, along one wall an accounting machine, reproducing punch, and three card punch machines are located. An accounting machine, reproducing punch, alphabetical interpreter, card punch, and sorter are plugged into the opposite wall. Future needs may alter the type of equipment in this section.

In the EDP section, power for the 1400 series IBM machines are provided by a bus system located on the floor below. Two separate feeds, each 40-amp., 4-wire, 3-phase, are used. One feeds the 1401, 1402, 1403 and 1407 units, the other the 1405 and 1405 compressor.

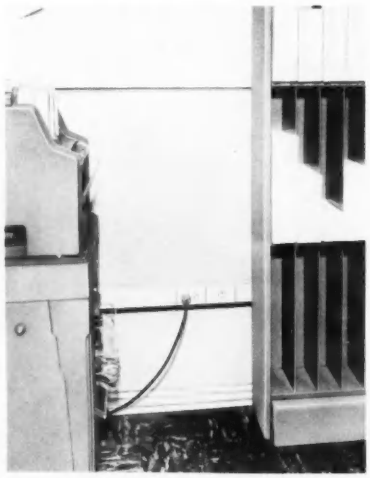
A Tele-Power run consisting of Plugmold 2000 (for low voltage wiring) above a run of 22GA30 (to provide outlets for test equipment and portable instruments). Two circuits are provided in the power run.

In the programming office, two runs of 2200 were used, providing a two-circuit, alternately wired grounding power run above one for telephone wiring.



SIX CIRCUITS of 20-amps. each provide reserve power for future use. The use of multi-outlet strips assures a conveniently located outlet for all machines.

PLUGMOLD 2200 Special was developed to provide receptacles on two levels. A run of 2000 provides a third level. Outlets are alternately wired on 30-in. centers.



WIREMOLD 3000 run carries both 220-v. and 110-v. service for data processing machines. Twist lock plugs add safety.

SERIES 50 IBM installation uses Plugmold 2100. Runs are located so as to keep cables out of walking area.

WIREMOLD®

Advertisement

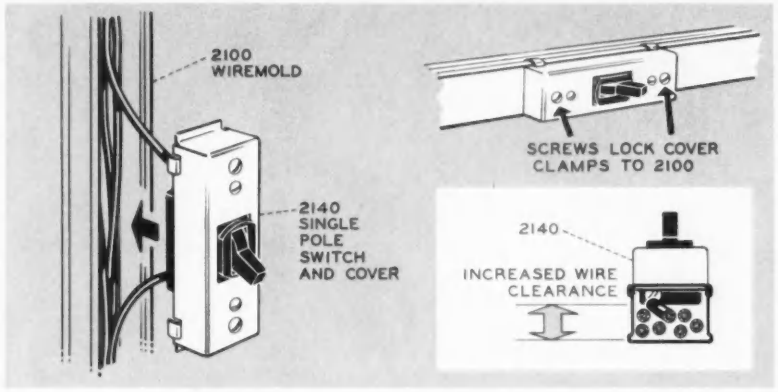
Product of the Month

Redesigned 2140 switch has improved versatility

Redesigned to provide simpler method of attaching to the 2100 base and to accept an interchangeable type switch, the new 2140 features increased versatility.

The cover, approximately 3-1/4 in. long, is fabricated of .040" steel designed to be held securely to the base by means of cadmium plated spring steel "ice tong" type clamps. Further, the cover has sufficient depth to accept any interchangeable type switch of the same depth and maintain the listed wire capacity for the 2100.

The new cover is furnished with a 15 amp., 120-177 v. A.C. standard type interchangeable switch approved for control of incandescent and fluorescent lamp loads to full-rated capacity. Also, the switch may be used for motors when the load is not more than 80% of the current rating of the switch.



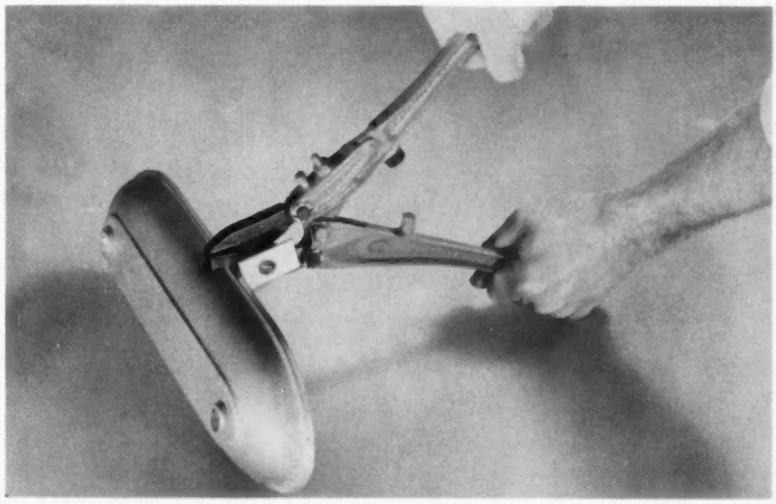
Practical Tips

Canopy cutter makes accurate, standard openings

The 657 Canopy Cutter eliminates the tedious and haphazard cutting of fluorescent fixture canopies to take Wiremold 500 or 700.

With this powerful, heavy-duty tool, it takes only a moment to cut accurate, standard openings in the canopy. Shaped and used like a pair of pliers, the 657 has a size gauge for 500 or 700 raceway. Simply set the gauge and cut through the fixture canopy with maximum efficiency and minimum effort.

This tool, designed to give long service, assures a perfectly fitted job without distorting the metal.



Noteworthy

Cool thought

We have always believed that business is best conducted in a comfortable, relaxed atmosphere.

Because of this, and despite air conditioning, our people frequently work in their shirt sleeves, even if they're meeting with visitors.

And, because we like to share our comforts, this sign at our reception desk invites visitors to be comfortable, too.

> Enjoy our air conditioning, but don't feel you have to wear your coat. We don't.
> Make yourself comfortable.

Corrections

Two errors have inadvertently crept into past issues.

In discussing the permissible load for branch circuits having two or more outlets (Code Comments, May 1962), we neglected to point out our answer primarily was concerned with 15 and 20-amp. circuits. Section 210-24 (a) states: "Lighting units and/or appliances. The rating of any one portable appliance shall not exceed 80 per cent of the branch circuit rating. The total rating of fixed appliances shall not exceed 50 per cent of the branch circuit rating when lighting units or portable appliances are also supplied."

June's Quiz Corner incorrectly states that Plugmold 2000 can be wired with 3 circuits with outlets on the circuits alternated. If this type of wiring is desired, Plugmold 2200 should be used.

Worth Reading

Check coupon on fourth page for copy of listed item.

High Intensity Light Achieved in Eastern Air Line's Hangar, Qualified Contractor, April 1962. Describes how Wiremold simplified installation of mercury vapor and incandescent system in new hangar.

WIREMOLD®

Advertisement

Engineered Specials

Special 3010C for feeding side of raceway with conduit

PROBLEM:

To provide a means of feeding a continuous run of Wiremold 3000 through the side with 3/4-in. or 1-in. conduit.

SOLUTION:

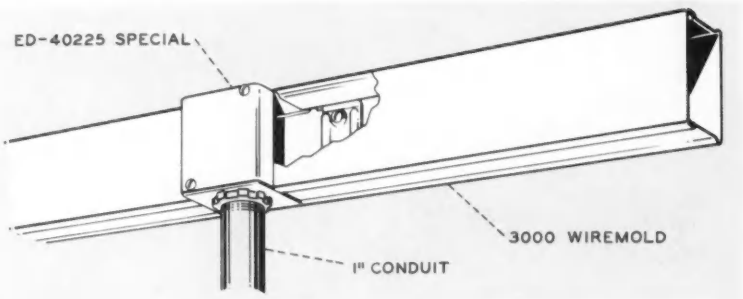
Using as the basis the 3010C, a special fitting, ED 40225, was made, with a double entrance for the raceway and with 3/4-in. and 1-in. concentric ko's on both sides.

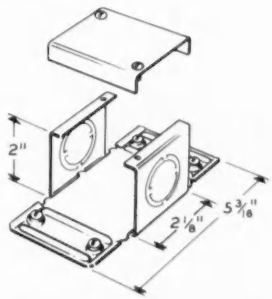
DISCUSSION:

An engineer designing a laboratory wanted to maintain the width of a continuous run of 3000 raceway and still be able to feed it from either side with a maximum 1-in. conduit.

The ED 40225 permits doing this without taking away from the cross section of the raceway. The removable cover permits easy accessibility and the added height provides additional splicing room.

Wiremold engineers are happy to develop new products to meet in-field problems.





Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner
The Wiremold Company
Hartford 10, Conn.

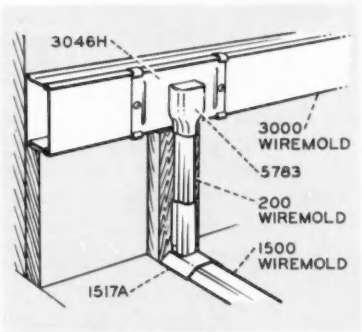
Q. *Is there any way of grounding Plugmold 1900?*

A. Continuity of ground is maintained through the use of standard connector fittings.

Q. *Is a mounting strap available for use with Plugmold 2000?*

A. Mounting strap is not necessary. Plugmold is mounted directly through the base which is furnished with piercings and mounting screw ko's.

Q. *I have an installation where Wiremold 3000 is installed above a 3/4" x 5-1/2" wood base. How do I connect this 3000 to 1500 on the floor?*



A. Through a combination of three fittings: 3046H fixture and drop cord cover, 5783 elbow box connector, and 1517A adapter fitting.

WIREMOLD ■ HARTFORD 10, CONN. E2-7

Gentlemen: Please send free the checked items

NAME _____

COMPANY _____

ADDRESS _____

☐ Qualified Contractor Reprint
☐ Electric Ideas, June 1962
☐ Electric Ideas, May 1962
☐ Wiring Guide (Catalog 22)

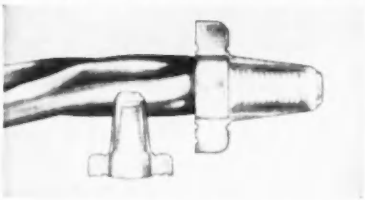
WIREMOLD®
HARTFORD 10, CONNECTICUT
In Canada: Conduits National Co., Ltd.
Toronto 2, Ontario

All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

Advertisement

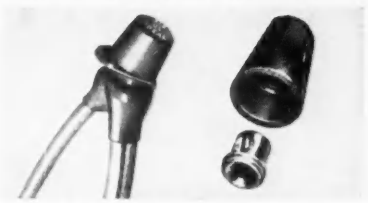
Contractors' Mart

THESE POPULAR IDEAL PRODUCTS ARE ALL AVAILABLE FROM YOUR LOCAL DISTRIBUTOR



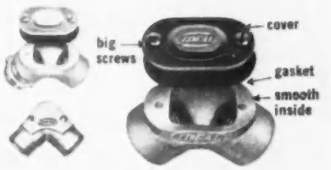
Built-in wrench. Unique wings make WING-NUT easiest wire connector to screw on heaviest branch circuit wires. Splice is visible inside tough nylon shell. U.L. listed for 600 volts as pressure cable connector, and 105°C. U.L. approved for aluminum and solid and/or stranded copper wires. 2 sizes of WING-NUT available to meet all pigtail splice needs.

America's favorite! WIRE-NUT has long-proven performance record as lowest-cost method for all common branch circuit and fixture wire connections. Strongest, shake-proof wire joint possible. All 5 sizes U.L. listed as 300v fixture; large sizes 74B & 76B as 600v pressure cable connectors. Use WIRE-NUTS in all types of conduit, cable, non-metallic sheath and open wiring.



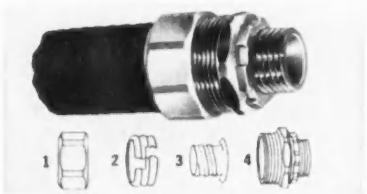
Select Set-Screw or Crimp. Only Ideal CRIMP has WRAP-CAP that insulates all around and even between wires. 600v U.L. approved for cadmium plated steel sleeve and vinyl 1-piece WRAP-CAP . . . now 2 sizes. 3 sizes of Ideal SET-SCREWS. All U.L. listed. Shell and connector easily removed and re-used. Tough shell has long skirt to prevent flash-over.

Cut "fishing" time. Highest grade, oil-tempered flat spring steel FISH TAPES will not curl. Flexible and easy for long, multi-bend conduit runs. Steel reel holds tape, is handled with safe, sure grip and ends danger of bending, kinking or breaking tape. Used with flexible leader, solves 90% of fishing problems. ⅛" and ¼" tapes in 50, 100 and 200 foot coils.



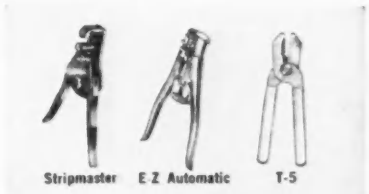
Easiest way around! Ideal PULLING ELBOWS & ADAPTERS make wiring around corners a snap. Precision milled of malleable iron for rugged strength and perfectly smooth pulling. Precise 90° fit. Cadmium plated, chromate treated. Supplied assembled, complete with rigid domed cover, full neoprene gaskets and BIG screws. ½" to 2" sizes, in three styles.

Double protection—Ideal VOLTAGE TESTER has a solenoid, calibrated indicator **and** a neon test lamp . . . each independent of the other. Safest, easiest for rugged daily use. Plastic safety yellow case, no-slip prods, prod storage space, fits pocket. Tests voltage, frequency, AC or DC, continuity, etc. Also model with resistor-fuses in prods to prevent arcing.

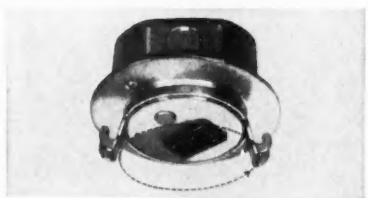


Vap-Oil-Tite—only completely reusable connectors for liquid-tight, flexible metallic conduit. Perfect seal. Positive ground, covers raw conduit end, fits EF and UA. U.L. approved. 90°, 45° and straight for ⅜" to 4" sizes. Easy to apply: Slip ring nut (1), and split ring (2), on conduit. Screw grounding bushing (3) inside conduit. Tighten ring nut over connector (4).

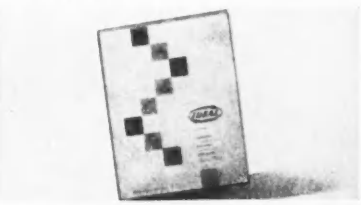
"Yellow 77" is new! Creamy wire pulling compound made with wax base. Works best where pulling is toughest. Exceptionally slippery, stays with wire in long runs. Won't quit half-way thru conduit run. Won't wash off. Always leaves a waxy film for repulling wires later. Safe, clean, harmless to hands and rubber or plastic covered wires or cables.



Strip wires fast and easy. "One-squeeze" STRIPMASTER strips both solid and stranded wire in 2 seconds. Heavy-duty E-Z AUTOMATIC cuts thru toughest insulation and strips wires clean without crushing ends. Low cost T-5 STRIPPER cuts, strips and loops wires. Fits flat in pocket. Strips 10 to 18 gauge. Many other special Ideal hand stripper models available.



Fixture hanger aligns after mounting. Hanger adjusts full 360° after mounting. Eliminates problems of mounting hanger in precise position. Lets you change fixture alignment any time lighting plans require. Wide choice of polarized receptacles. Supplied with chains and cord clips. Vibration-proof safety brackets optional. U.L. approved.



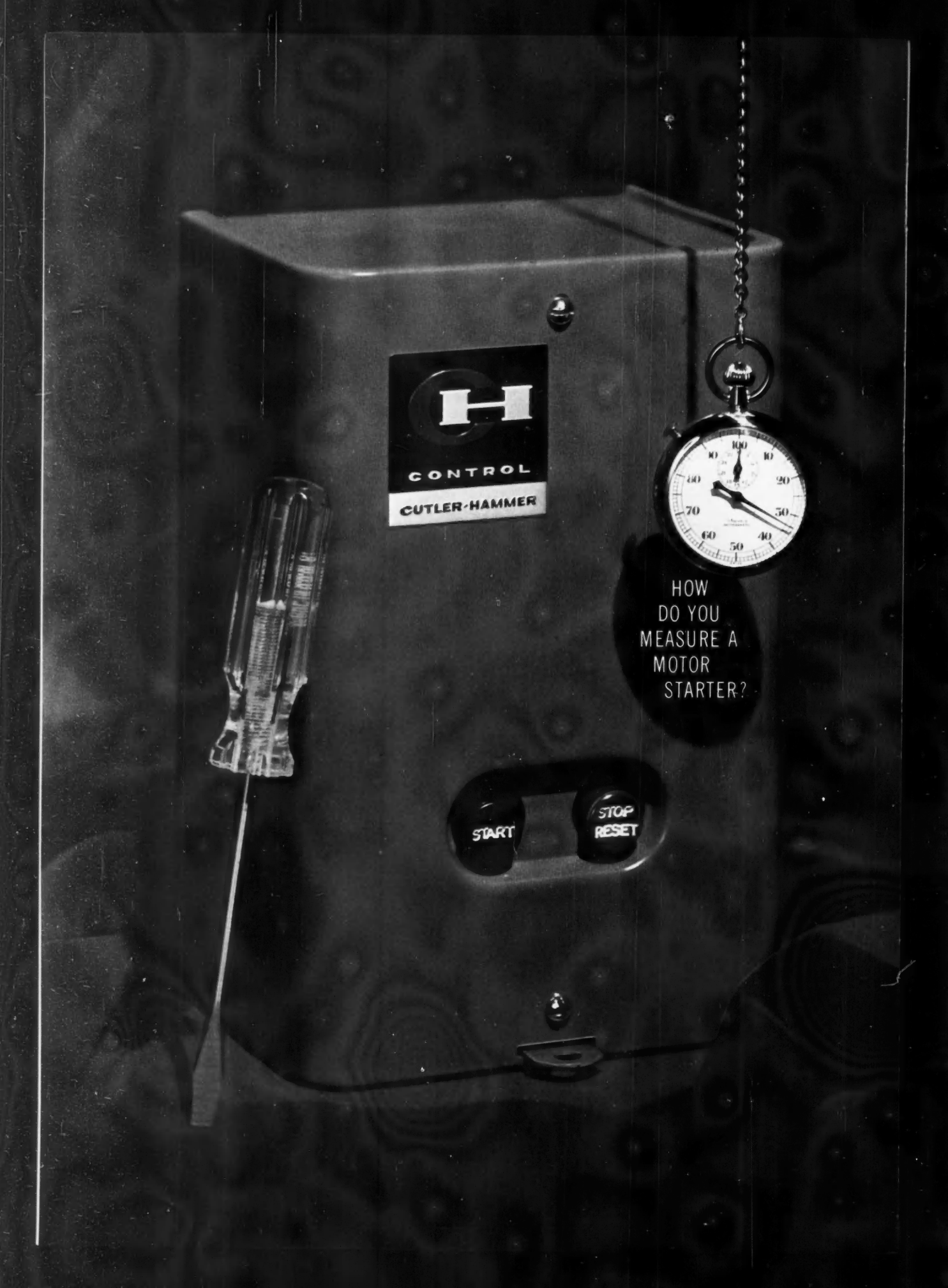
FREE CONTRACTORS' PRODUCT CATALOG. You can obtain your own free copy of the complete Ideal Contractors' Catalog giving details on thousands of items you need for regular and special electrical jobs. For free copy, send your name, company name, and address to IDEAL INDUSTRIES, at address shown at right. Write today!

IDEAL

THE HELPING HAND ON EVERY WIRING JOB

IDEAL INDUSTRIES, INC.
1041-G Park Avenue
Sycamore, Illinois
In Canada: Irving Smith, Ltd., Montreal.

All the fine maintenance products above are manufactured by IDEAL. All are available from your local IDEAL DISTRIBUTOR.


CONTROL
CUTLER-HAMMER
START
STOP
RESET
HOW
DO YOU
MEASURE A
MOTOR
STARTER?

What do contractors say about motor starters?

"We demand top quality product and performance, but our choice is often made on other factors"

Quick installation? It's money in a contractor's pocket. Easy maintenance? One key to a satisfied motor starter customer. Today, nobody will buy a starter that doesn't deliver these important benefits.

And these are qualities that have long been built into all Cutler-Hammer motor starters.

But we've also been aware that certain *non-product* factors are important to a contractor's business. Recently a group of 254 typical and important buyers of motor starters told us how *really* important they consider these non-product measurements. These, they said, determined their choice in many cases:

1. AVAILABILITY

Local stocks are considered a must by buyers. And with Cutler-Hammer, more than 600 distributors maintain balanced stocks. Complete starters or required replacement parts are just a phone call away. They're backed up by 66 district offices and 17 regional warehouses. The 91% of your motor starter requirements that you need in a hurry are available *locally*. Even special requirements can often be handled overnight.

2. SERVICE

Service was the next most-mentioned factor. And you'll find Cutler-Hammer service better than ever. Both the distributor and the Cutler-Hammer man will treat your problem as their own. Together they'll be able to handle your problems—and emergencies—in just hours.

3. COMPLETE PRODUCT LINE

Being able to get the right starter when needed naturally ranks high in importance with buyers. With Cutler-Hammer, you get exactly the starter you need to do the job right. Cutler-Hammer has 10 NEMA sizes, 00 through 8.

For complete details on the starter line designed to industrial standards, proven in thousands of applications and exceeding NEMA requirements in every respect, send for publication LO-70-N241.

So next time you're talking about motor starters . . . talk to Cutler-Hammer. You know the reputation of our products . . . call your nearby Cutler-Hammer distributor and find out about his service!

WHAT'S NEW? ASK...

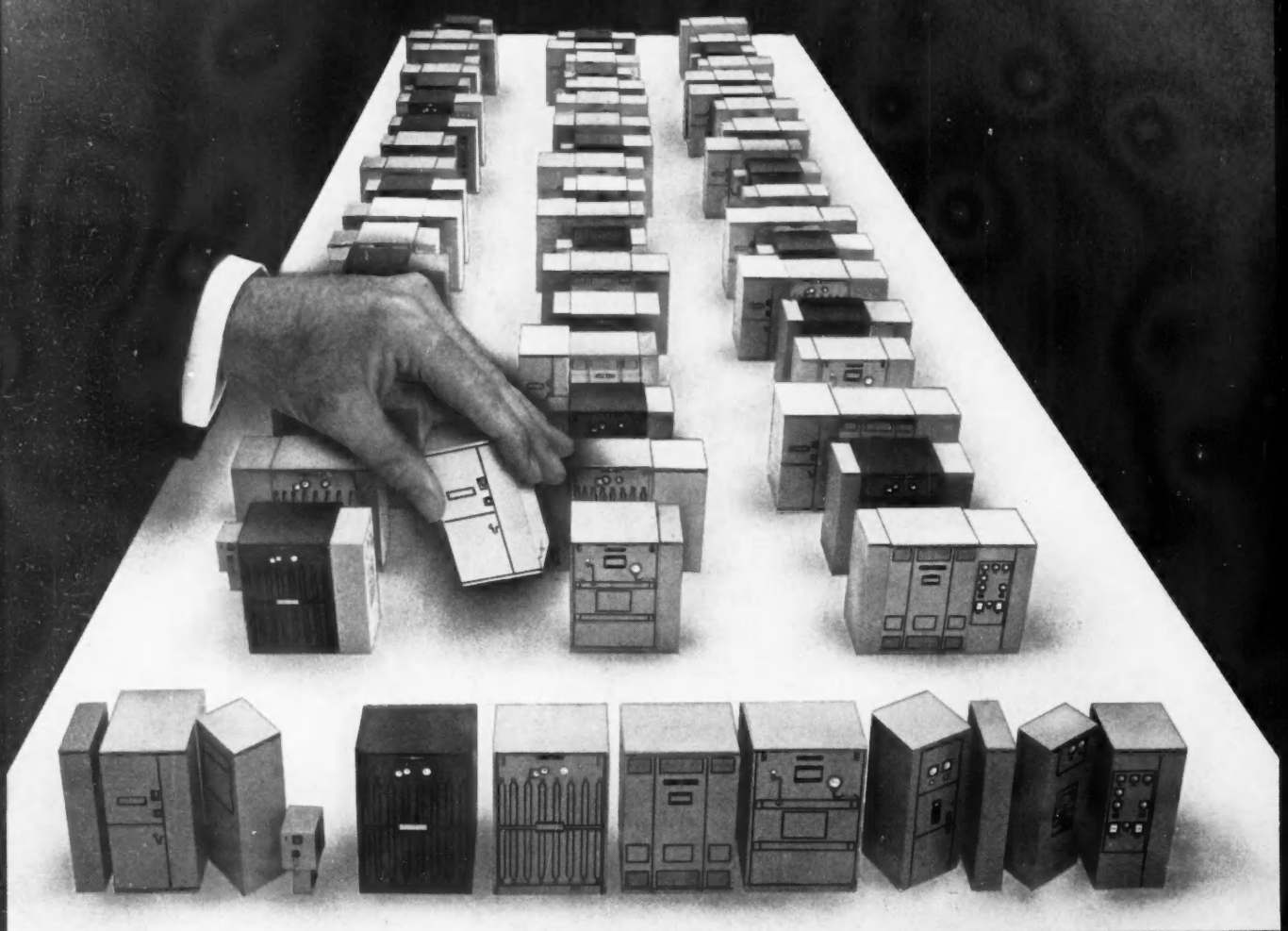
CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S.A.

FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

- Superior design, features, and performance
- Faster shipment
- Complete service

12 building blocks



INCOMING SECTIONS

TRANSFORMING SECTIONS

OUTGOING SECTIONS

GE ON VALUE

to economy, shorter shipment

Now General Electric can tailor Integral Distribution Centers for every load through 2500 kva

Whatever your load requirements, General Electric can give you fast shipment on dependable, economical Integral Distribution Centers that are just right for the job. Twelve basic incoming, transforming, and outgoing sections—plus optional features—provide industry's most complete range of power packages.

Standardization makes it possible to refine these basic building blocks to high value levels. For example, a recent redesign of our liquid-filled transformer has cut space needs by as much as 21 percent. And new developments in insulation significantly increase transformer life. Manufacturing economies keep prices low. Shipments average six weeks.

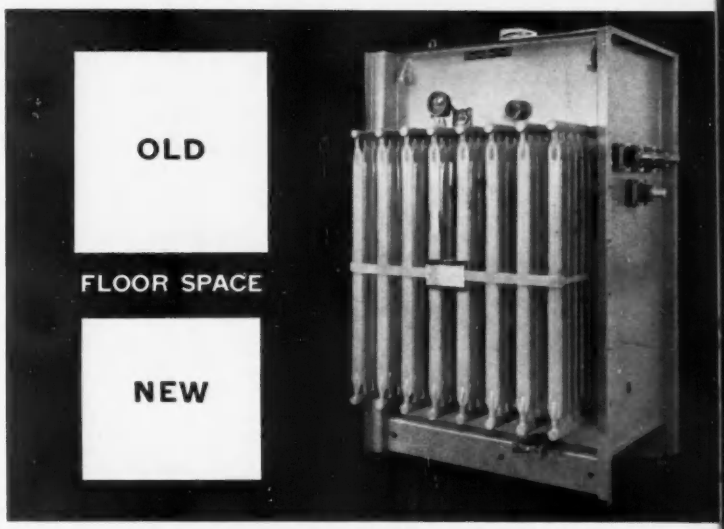
Rated from 112½ to 2500 kva, General Electric's Integral Distribution Centers are made up of these building blocks:

- **Four high-voltage terminations:** air switches with or without stored-energy mechanism (two types), oil cutouts, liquid-filled switches, or full-length cable termination compartments.
- **Four transforming sections:** oil-filled, Pyranol* filled (both 112½ to 2500 kva), open dry-type, gas-filled sealed dry-type (both 300 to 2500 kva).
- **Four low-voltage terminations:** AK circuit breaker; full-length terminal compartment; molded-case circuit-breaker, or fusible-disconnect-switch panelboards (both available with motor starters).
- **Metering, relaying** are available options.

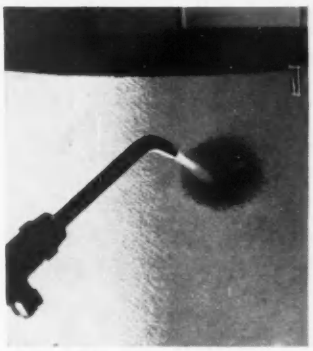
Each Integral Distribution Center is shipped to you in a single, pre-wired package† to lower your installation costs.

Contact your General Electric Sales Engineer, or write for bulletin GEA-7222, General Electric Co., Schenectady, N. Y. 417-12

*Reg. Trade-mark of General Electric Co.
†Air switches shipped separately



UP TO 21% FLOOR-SPACE REDUCTION of liquid-filled transformers typifies continuous improvement of General Electric Integral Distribution Center components.



ALPHOLITE* INSULATION provides inorganic dielectric barrier for all dry-type units.

THERMALLY UPGRADED insulation system gives liquid-filled transformers longer life.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Fewer lamp replacement trips...

fewer work interruptions...

when fixture ballasts wear the CBM emblem

Lighting maintenance costs less . . . and there's less work interrupted by replacement of lamps . . . when lighting fixtures are equipped with Certified CBM Ballasts. Because CBM specifications assure ballast performance that makes for longer lamp life (up to 2500 hours longer) and longer ballast life, along with sustained high light output.

And you get performance checked by Electrical Testing Laboratories, plus UL listing. So when you specify or install fluorescent lighting, *insist* on CBM Ballasts . . . made by leading manufacturers. To keep up-to-date on ballast developments, ask us to send you CBM NEWS.

CERTIFIED BALLAST MANUFACTURERS, 2116 Keith Building, Cleveland 15, Ohio.

Participation in CBM is open to any manufacturer who wishes to qualify.

8-62

Only BURNDY offers all three!

THERMOWELD® — COMPRESSION — BOLTED

thermOweld

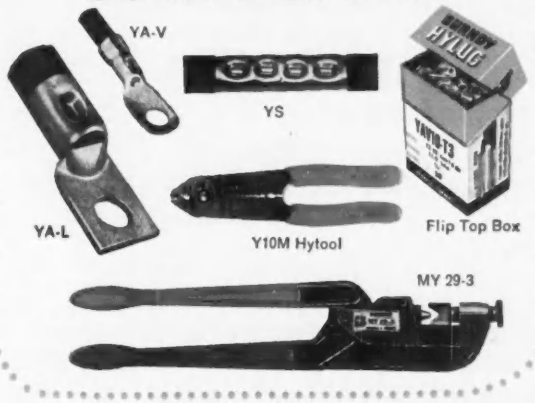
Weld anywhere with lightweight THERMOWELD. Self-contained, needs no external source of power.

Pour powder into mold, tap. Starting powder won't mix with welding powder, assures positive firing.

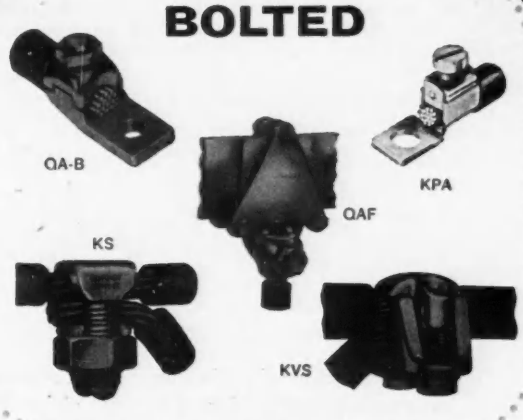
Close cover, ignite with flint gun. THERMOWELD forms liquid copper which fuses conductors into solid mass.

Welds a permanent electrical connection easily and economically to any copper conductor or steel structure.

COMPRESSION



BOLTED



AVAILABLE AT YOUR BURNDY DISTRIBUTOR

BURNDY

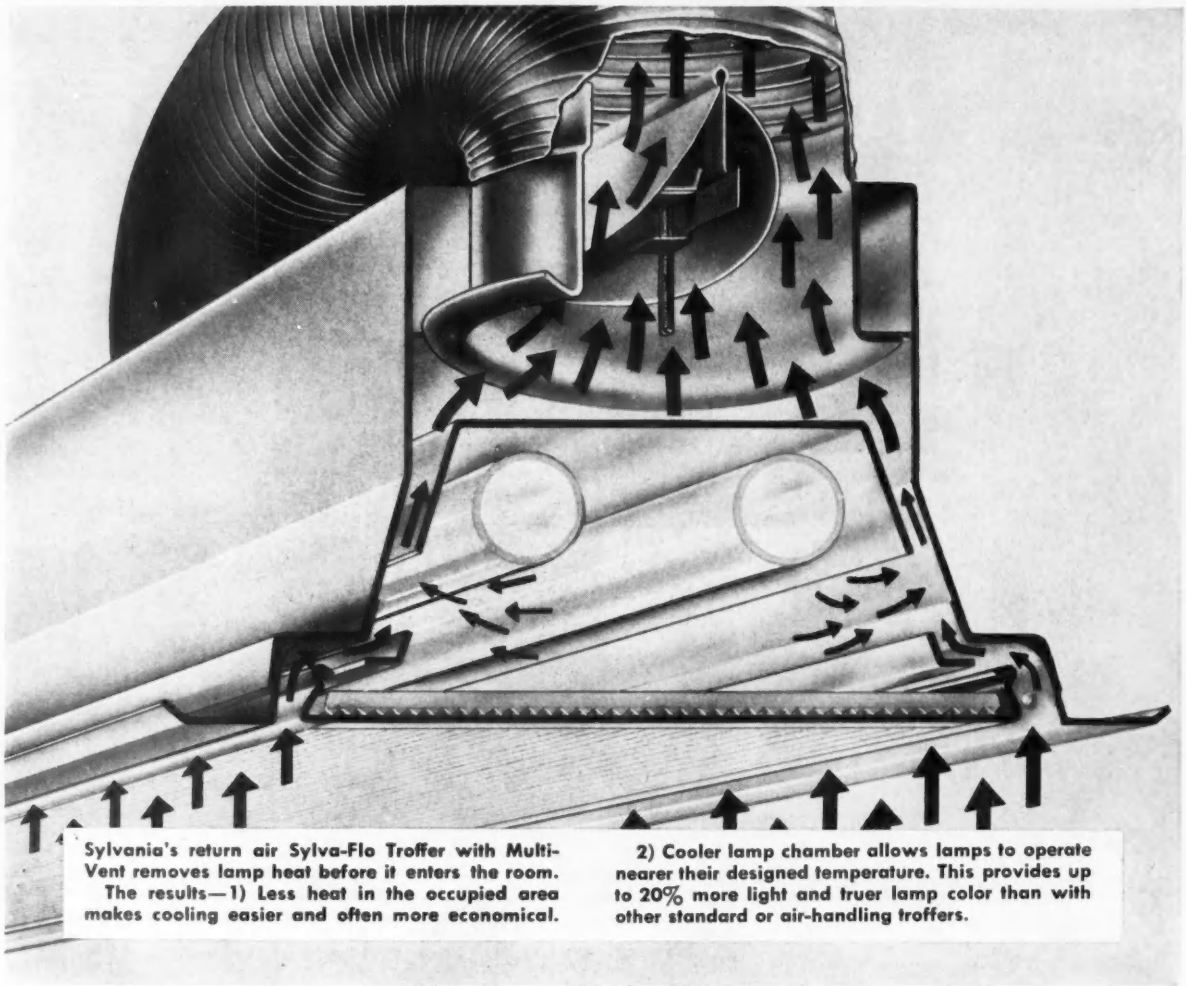
01-12

NORWALK, CONNECT. BICC-BURNDY Ltd. Prescot, Lancs., England In Europe: Malines, Belgium TORONTO, CANADA

(Advertisement)

It's more practical to remove warm air than it is to cool it!

EXAMINE THE 'COOL' FACTS WHEN SPECIFYING AIR-HANDLING TROFFERS



Sylvania's return air Sylva-Flo Troffer with Multi-Vent removes lamp heat before it enters the room. The results—1) Less heat in the occupied area makes cooling easier and often more economical.

2) Cooler lamp chamber allows lamps to operate nearer their designed temperature. This provides up to 20% more light and truer lamp color than with other standard or air-handling troffers.

Lighting systems contribute a substantial amount of heat that must be removed when areas are air-conditioned. Today's higher lighting levels mean increased wattages . . . and more heat to be removed.

Here's how you can reduce this heat load to make cooling easier and to provide better lighting efficiency at the same time.

You hear and read many claims these days about different types of air-handling troffers. Many of these claims are contradictory. The result is that many potential users of combination lighting and air-handling units are confused.

Here, in simple form, are the technical facts about the design and application of Sylvania's Sylva-Flo Troffers with Multi-Vent.®

The cross-section of Sylvania's Sylva-Flo Troffer with Multi-Vent is shown in detail on these pages. Note particularly that the air flow is controlled along the sides of the lamp chamber without being directed over or onto the lamps.

This design has a decided effect on both the air-handling performance of Sylva-Flo Troffers (with special regard to HEAT) . . . and to the lighting performance as well. Let's look at these separately.

RETURN AIR SYLVA-FLO MULTI-VENT PERFORMANCE

Consider the basic reason why the air is conditioned . . . to keep the occupants of the area comfortable by cooling in warm weather.

In any installation the lighting system makes up a substantial amount of the heat that must be removed in this cooling cycle.

Sylvania's Sylva-Flo Return Air Troffer is designed to *remove most of this lamp heat before it even enters the occupied space.* This means that in the occupied space there is less warm air that needs cooled.

Other return air-handling troffers, where the lamp chamber is completely isolated from the air flow, remove only a small amount of this lamp heat. A large percentage of the lamp heat enters the room area and adds considerably to the heat load.

From a cost standpoint, removing the hot air before it enters the room means that duct, motor, and fan sizes can be reduced in many cases because the air-handling system does not have as much warm air to cool.

This, in turn, means that initial and operating costs can be lowered with Sylvania's Sylva-Flo Troffers.

SYLVA-FLO LIGHTING PERFORMANCE

The Sylva-Flo construction allows the continual withdrawal of heat from the lamp chamber—in both the supply and return units . . . *to keep the lamp chamber cool.*

This is extremely important from a lighting standpoint.

Both *lighting efficiency* and '*lamp color*' can be affected by the ambient temperature around the lamp. Let's look at each of these points:

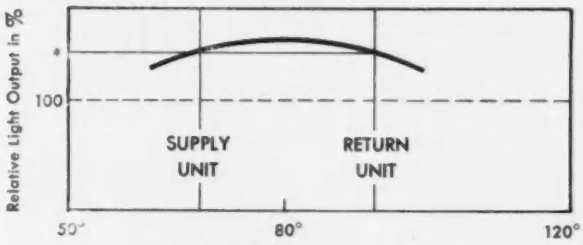
Lighting Efficiency: Fluorescent lamps are designed and built to operate most efficiently (i.e. to provide their greatest light output) at approximately 80° F ambient temperature. This is the normal operating temperature of a fluorescent lamp when used in a pendant-mounted, bare-lamp lighting fixture.

In conventional troffers the temperature in the lamp chamber rises as high as 120° to 130° F. As the temperature rises above 80° F, the light output of the lamps drops off. The higher the temperature, the less light is produced.

In Sylvania's Sylva-Flo Troffer, the continual withdrawal of heat from the lamp chamber during either the cooling or heating cycle permits the lamps to operate nearer the correct temperature. Thus the lamps operate *more efficiently* and produce *more light* than in troffers where the lamp heat is trapped and cannot escape.

This increase in light output with Sylvania's Sylva-Flo Troffers *can be as much as 20%!*

TYPICAL LIGHT OUTPUT CURVE FOR SYLVA-FLO TROFFER WITH MULTI-VENT



AIR TEMPERATURE IN DEGREES F.

*Supply and return units have equivalent Output and Color.

'*Lamp Color*': The *color* of a fluorescent lamp, like its efficiency, is also affected by its operating temperature. To obtain the true color of a lamp as designated (cool white, warm white, etc.), it should be operated at an approximate temperature of 80° F.

Two fluorescent lamps of the same color designation operating at different temperatures may appear to be different shades. This is often referred to as 'color shift.'

In conventional troffers and in air-handling troffers where the lamp chamber is isolated from the air flow the operating temperature is higher than 80° F. This can cause color shift . . . even with return air units.

In an installation of Sylvania's Sylva-Flo Troffers where all fixtures handle air (either supply or return units) the lamp color is uniform (refer to light curve) . . . and it is nearer the *true* color of the lamp because of the cooler operating temperature.

Because of the cooling effect of the Multi-Vent principle —where all units handle air—a properly designed Sylva-Flo installation can use cool white or warm white lamps without fear of color distortion.

* * *

The points discussed here are important . . . but they are only a few of the many factors that must be considered when designing for air-handling troffers.

More information on Sylvania's Sylva-Flo Troffers with Multi-Vent can be found in Sweets. And these fixtures are discussed in detail in our 20-page booklet which we will gladly send you on request. Or, if you prefer, we will have our representative call to give you full particulars.

IMPORTANT INFORMATION

1. **Sylvania Sylva-Flo Troffers with Multi-Vent meet the specifications of the General Services Administration (GSA) for Air-Handling Troffers.**
2. **All models of Sylvania Sylva-Flo Troffers are listed by U. L. These include:**
   a) **Return units with plastic shielding.**
   b) **3-lamp, 1' wide units for heating or cooling.**

®—Registered Trade Mark, The Pyle-National Co.

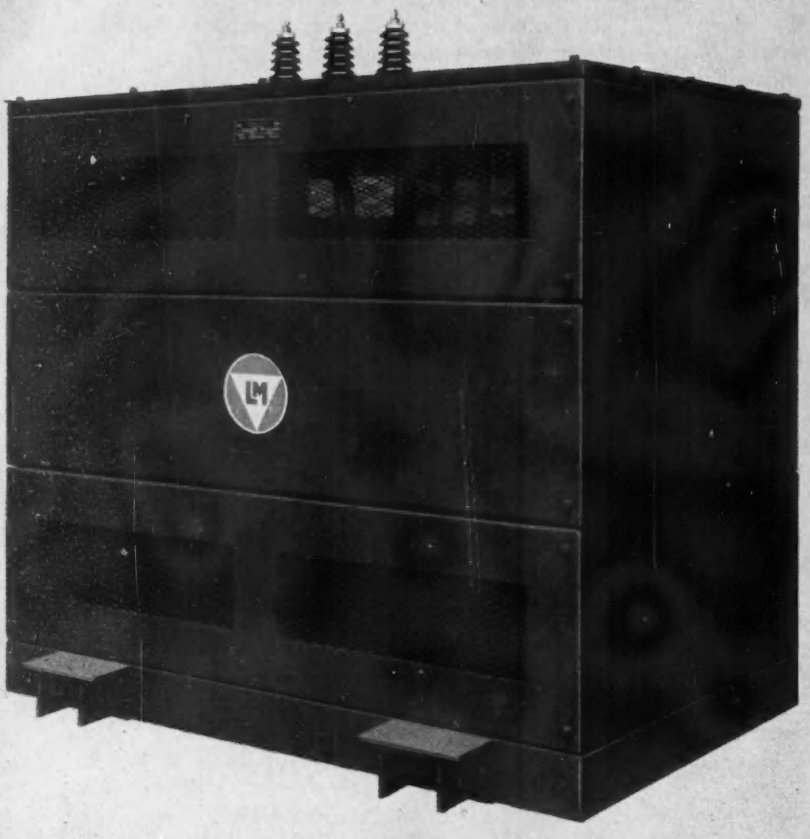
SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia

LIGHTING FIXTURES BY

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

L-M's Complete Line of Electrical Equipment Now Available To You



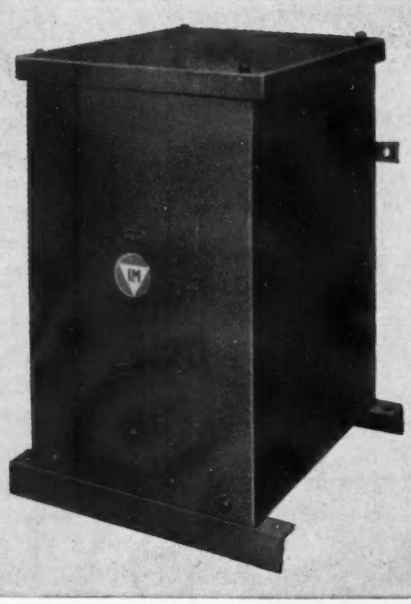
Oil Filled Distribution Transformers
Reclosers, Sectionalizers and Oil Switches
Fuse Cutouts and Fuse Links
Lightning Arresters
Power Switching Equipment
Packaged Substations; Feeder-Pak
Capacitors—power, secondary, dustproof, electronic; banks and racks
Regulators and New "Auto-Booster"
Line Construction Materials
Porcelain Insulators
Fibre Conduit and Pipe
Outdoor Lighting
And Now—Dry Type Transformers, too!

Line Material Industries—*THE TIE* between your customers and the electric utility.

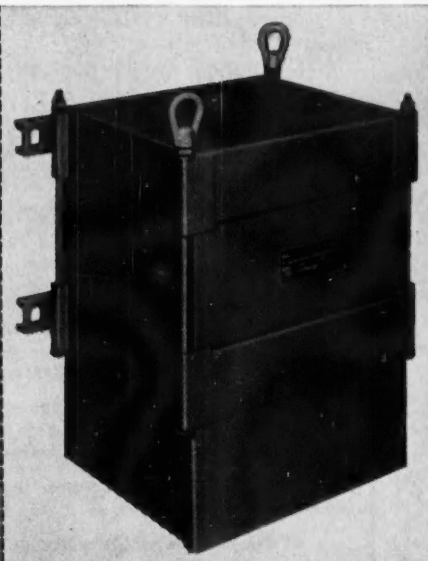
For further information on L-M equipment, ask your Authorized L-M Distributor, contact your L-M Field Engineer or write Line Material Industries, Milwaukee 1, Wisconsin.

THREE-PHASE DRY TYPE TRANSFORMERS, in sizes through 3000 kva. Available in floor and platform mounted types; vibration-free; quiet—with custom designs where extremely low db requirements must be met.

37½ THROUGH 75 KVA SIZES, three-phase, offer many desirable features; removable covers; adequate ventilation; low copper and core loss; improved regulation.



THIS UNIT, TYPICAL OF 15 through 250 kva, is offered in a wide choice of types and ratings for single-phase, and three-phase distribution.



L-M DRY TYPE TRANSFORMERS are available in all sizes from 50 va up. Here is a typical 10 kva single-phase unit designed for wall or ceiling mounting.

W. S. KINGSOLVER, Line Material's Manager, Distributor Sales, introduces L-M's outstanding new line of dry type transformers.

L-M Offers Complete Line of Dry Type Transformers Through L-M Distributors

Line Material Industries has expanded its product line to include dry type transformers. A complete line available to you through your L-M distributor. Sizes range from 50 volt-amperes up through 3000 kva.

Your L-M distributor maintains a stock calculated to give you off-the-shelf delivery on popular sizes. He is backed up by an extensive factory inventory to provide you with immediate shipment of almost all standard sizes.

L-M dry type transformers are also available as custom designs. Design experience and versatility make it possible for your distributor to supply transformers exactly as your customers specify them. He is also happy to work with you on standard transformers with a few minor modifications. The factory provides prompt quotations, drawings and delivery.

All L-M dry types meet or exceed ASA, NEMA, AIEE and National Electric Code standards.

All L-M dry types are designed to be quiet—at NEMA noise levels or below. Custom designs are available with db levels below standard for applications where noise is a problem.

Your L-M distributor is anxious to work with you on all your transformer problems. Your distributor is backed up by L-M's complete team of Field Engineers and Apparatus Engineers. This group of technical experts, teamed with your distributor, is happy to work out problems. Consult them.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Distribution Specialists

McGRAW EDISON

565

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Now...11 J-M Dutch Brand® electrical tapes are available in the best dispenser in the business!

Now you can have the finest plastic electrical tape in the industry, packaged in the handiest tape-and-tear dispenser tool ever designed! Johns-Manville Dutch Brand Dispensers make any electrical job quicker. A special "grip strip" makes for fast, easy starting . . . saves time! What's more, you can choose from 11 different electrical tapes to fit your particular job. Here they are:

- **Black plastic electrical tape in standard 66′ rolls.**
- **Black plastic electrical tape "job size" 44′ rolls.**
- **Special Cold-Weather plastic electrical tape in standard 60′ rolls.**
- **Vinyl tape in eight colors, for color coding, job identification—in red, green, orange, blue, yellow, brown, silver and white— available in 66′ rolls.**

Look at all the important advantages you get with this new dispenser tool —permanently shielded cutter . . . no moving parts to snag hands, clothes . . . can't clog . . . "tape and tear" with one hand . . . contains the finest plastic electrical tape made...pre-loaded, ready to use . . . protects tape against dirt, grease . . . big center hole for easier handling . . . no extra cost!

These J-M Dutch Brand tape-and-tear dispenser units can help you do your job with less effort and more economy! Get the full story from your Dutch Brand Distributor. Or write Johns-Manville, Box 359, New York 16, N. Y. In Canada: Port Credit, Ont. Cable: Johnmanvil.

JOHNS-MANVILLE JM PRODUCTS

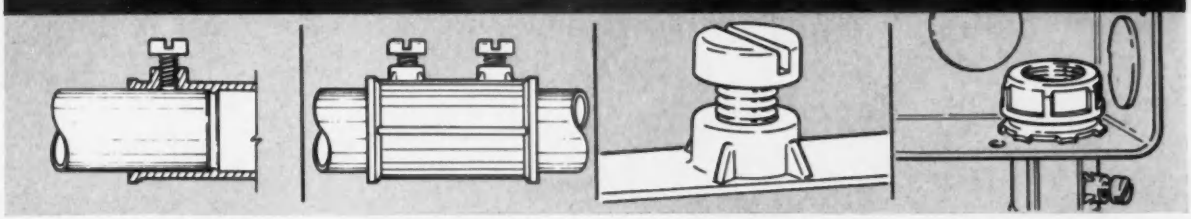
JOHNS-MANVILLE
DUTCH BRAND TAPE

New RACO E.M.T. pressure cast Set Screw Fittings with HI-BRITE Finish

Set screw connectors
½" to 2" concrete tight.

Set screw couplings
½" to 2" concrete tight.

Screws staked flush to inside . . . no back off . . . can't fall out



Screws fit flush with inside, never have to be backed off.

These screws stay put, won't fall out and can't get lost.

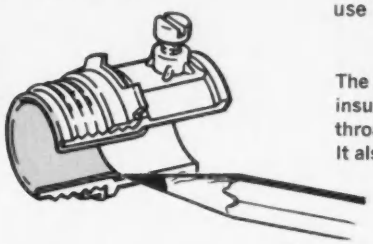
Reinforced screw hub increases strength.

Designed to accommodate insulating or capped bushings.

These pressure cast set screw fittings really save you time and money on the job. Staked screws are flush with the inside. You never have to back off screws. And screw drivers won't slip out of the large deep slotted screw heads. Furthermore, the screws stay put. No time wasted looking for lost screws.

The body of these fittings is constructed of long lasting, high quality alloy with Hi-Brite corrosion-resistant finish. The reinforced screw hub design gives added strength. RACO E.M.T. pressure cast set screw connectors are designed to accommodate insulating or capped bushings with ease. Save time and money, use RACO set screw fittings.

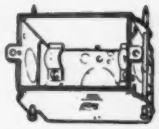
Newly Designed E.M.T. Insulated Throat set screw connector



The cutaway, at the left, shows how RACO has rolled the insulated throat over the shoulder. This feature prevents throat from falling out, even with temperature changes. It also eliminates the need for a separate plastic bushing.

Extra long throat accommodates all new types of flexible metallic cable. **No. 2611**

Non-metallic cable connector with angled slot grips non-metallic cable securely. Extra long screws furnished. **No. 2711**



Switch box with S "stub" bracket. More wiring room. Staked nails are outside, won't interfere with device.

Two gang masonry thru-the-wall boxes for 4, "6" or 8" blocks—½" or ¾" KOS.

RACO®

ALL-STEEL EQUIPMENT INC. Aurora, Illinois

Architects:
HERBERT A. BENSON and GEORGE J. RIEHL,
New Orleans, La.

Electrical Engineers:
LOUIS N. GOODMAN and ASSOC.,
New Orleans, La.

Electrical Contractor:
WEISFELD and SON,
New Orleans, La.

Modern Saratoga Bldg.
KEEPS PACE ELECTRICALLY
with SAFETY!

BUSS fuses safeguard electrical system of 14-story New Orleans building ...allow for safe expansion of system to meet future load demands.

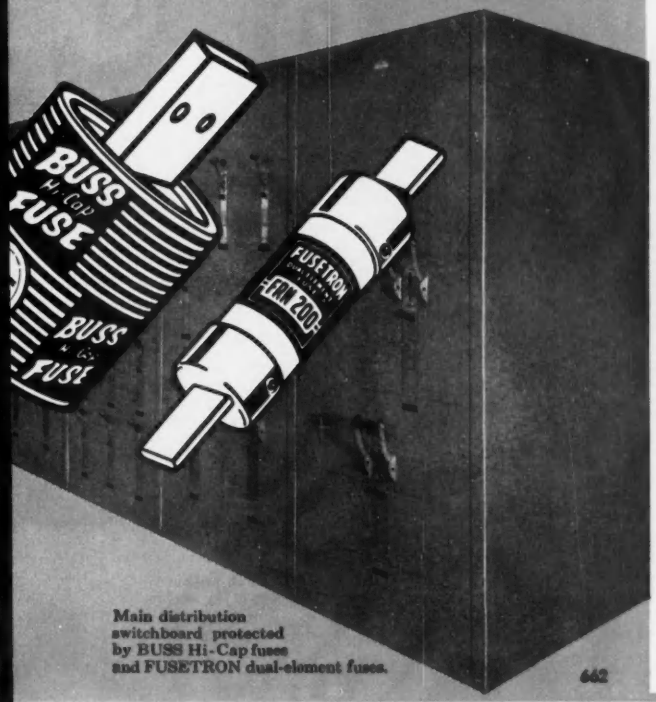
Seeking the ultimate in present-day electrical protective devices,—with ample interrupting capacity for today's conditions and to allow for future system growth,—fuses were specified for New Orleans' modern Saratoga Building.

BUSS Hi-Cap fuses were called upon to safeguard the main service entrance . . . including a 2,000 amp. air conditioning main, a 3,000 amp. tenant main and a 2,000 amp. house main.

FUSETRON dual-element fuses were specified to guard feeder circuits.

With BUSS Hi-Cap and FUSETRON fuses safe protection remains safe. After years of inactivity, these fuses provide the same safe, accurate protection if called upon to open as they would on the day installed.

The Saratoga Building installation is another example of the modern trend in electrical protection. Architects, engineers and plant operating men find that no other type of protective device can equal fuses for high interrupting capacity and lifetime, maintenance-free dependability.



Main distribution switchboard protected by BUSS Hi-Cap fuses and FUSETRON dual-element fuses.

642

Steadily Growing Power Requirements Re-emphasizes the Advantages of BUSS Fuses

With available fault currents reaching 75,000 to 200,000 amps.—safe, dependable interruption of fault currents is essential to guard against ruined equipment, danger of fire and possible injury to personnel.

To meet this demand for safety,—BUSS developed high interrupting capacity fuses with specific characteristics to meet your requirements. For example:

BUSS Hi-Cap Fuses

For loads above 600 and up to 6,000 amps. Have 200,000 amp. interrupting rating. High speed operation limits fault currents to safe values.

Ask for Bulletin HCS.

BUSS LOW-PEAK Fuses

A great advancement in protective devices. Have 200,000 amp. interrupting rating . . . provide great current limitation . . . plus long time-lag to prevent needless shutdowns.

Ask for Bulletin LPCS.

BUSS LIMITRON Fuses

Have 200,000 amp. interrupting rating. Extremely fast opening characteristics prevent heavy short circuit currents building up under fault conditions.

Ask for Bulletin HLS.

FUSETRON dual-element Fuses

All purpose protective device for circuits, motor or equipment protection. Have 100,000 amp. interrupting rating.

Ask for Bulletin FIS.

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.*
St. Louis 7, Mo.

* **KILLARK "GR" SERIES JUNCTION BOX...**

available in eight sizes from 4⅝" x 4⅜" x 4½" to 11" x 12" x 8¼". Choice of dome covers in four heights to facilitate heavy splicing or mounting terminal blocks. Also available with flat blank covers or lens covers for instrument mounting. Lens is heavy shock proof, stressed glass, as strong as the casting.

Copper-free aluminum casting with reinforced construction and convenient mounting lugs. Custom hubs can be placed where needed; drains and breathers available. Explosion-proof, dust-tight, and weatherproof.

There are more than 200 other Killark Junction Boxes from which to choose the exact style and size you need for any installation.

Write for illustrated catalog.

OVER 7,500 ELECTRICAL FITTINGS AND FIXTURES

Only Killark provides copper-free aluminum equipment in such a complete range of sizes and styles. Having the right enclosure available for the application means greater design freedom, better operating efficiency, lower costs.

YOU GET FAST DELIVERY ON KILLARK ELECTROLETS

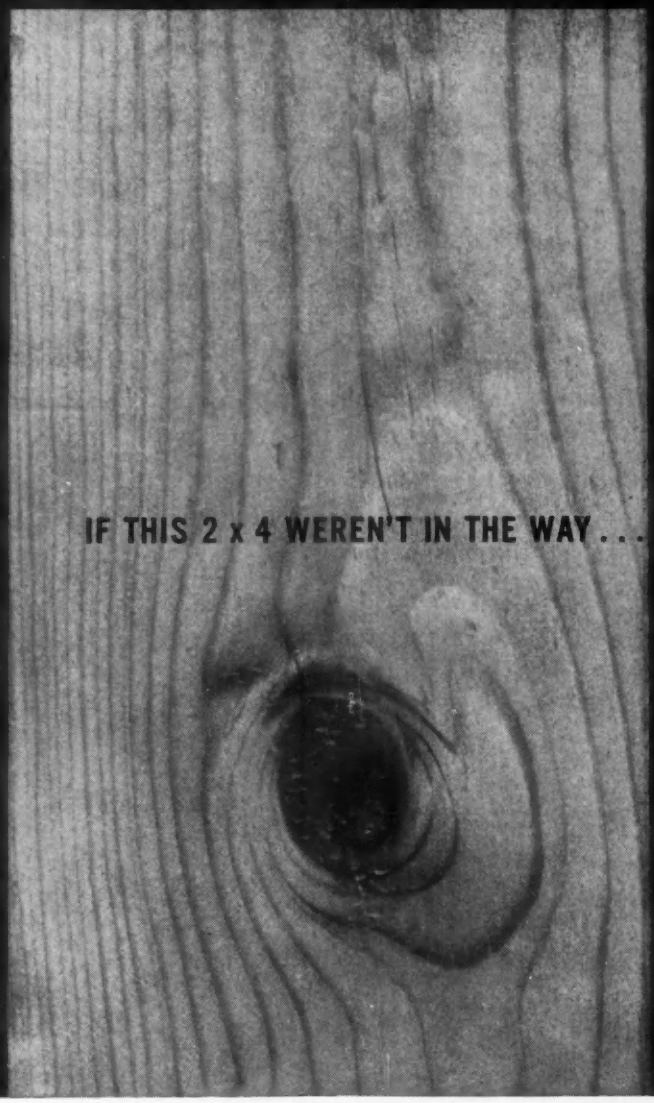
Order from your Killark distributor. He has the item you need in stock for immediate delivery. If not, he can get it promptly from a nearby Killark warehouse. There are 18 of these dependable supply sources located throughout the United States and Canada.

Killark

ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Ave. • St. Louis 13, Missouri

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.



YOU
COULD
SEE
MORE
OF OUR
NEW
3⅛"-THIN
200-AMP
SWITCHBOX

So slim that it mounts flush – even in dry wall construction.

And no features are sacrificed to achieve the new super-slim Clark-American 200-amp switchbox. You get plenty of knockouts, plenty of wiring space, AL/CU line lugs, positive bolt-in circuits, non-interchangeable branch pullouts h.p. rated for motor appliances, and up to 32 circuits by use of add-on feature.

This is modern Clark design, for modern construction of modern all-electric homes – models for indoor or outdoor installation.

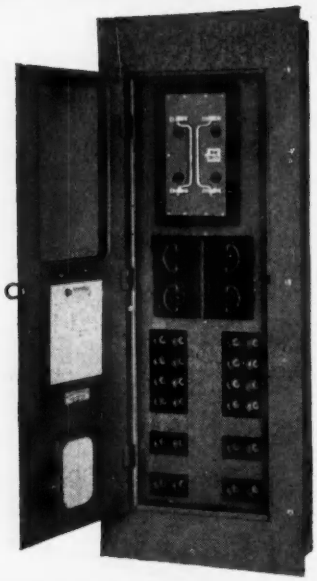
Compare all makes with Clark when you select your line of electrical equipment for homes, commerce or industry. Compare for quality construction, ease of installation and eye-pleasing appearance.

And, compare price. Clark-American equipment costs no more.

620E1

CLARK American
ELECTRIC SWITCH DIVISION

THE CLARK CONTROLLER COMPANY
Cleveland 10, Ohio



Less bulk, less weight, more features. Clark-American's new 200-amp switchbox is dry wall thin. Branch circuit pullouts don't protrude. Be sure to use it in finished utility rooms of electrically heated homes—no other switchbox does the job so well.

Control cable insulated with TEFLON® provides utmost accuracy

The outstanding insulating characteristics of TEFLON fluorocarbon resins are being put to good use in a variety of signal and control-cable constructions, particularly when accuracy and reliability must be maintained under difficult environmental conditions. A case in point: an electronic tank-level gauge (below) uses a low-level UHF probe to make its measurements. The long cable which transmits signals in both directions must maintain constant cable impedance, through wide variations in temperature, pressure, humidity and corrosive atmospheres and products. To achieve the required consistency and precision in measurement, Gilbert & Barker Mfg. Co., West Springfield, Mass., standardized on cable insulation of Du Pont TEFLON: primary insulation is tape of TFE resins; jackets are made of FEP resins. The manufacturer's comment on the new construction: "This is the ultimate—we have had no known insulation of jacket failures."

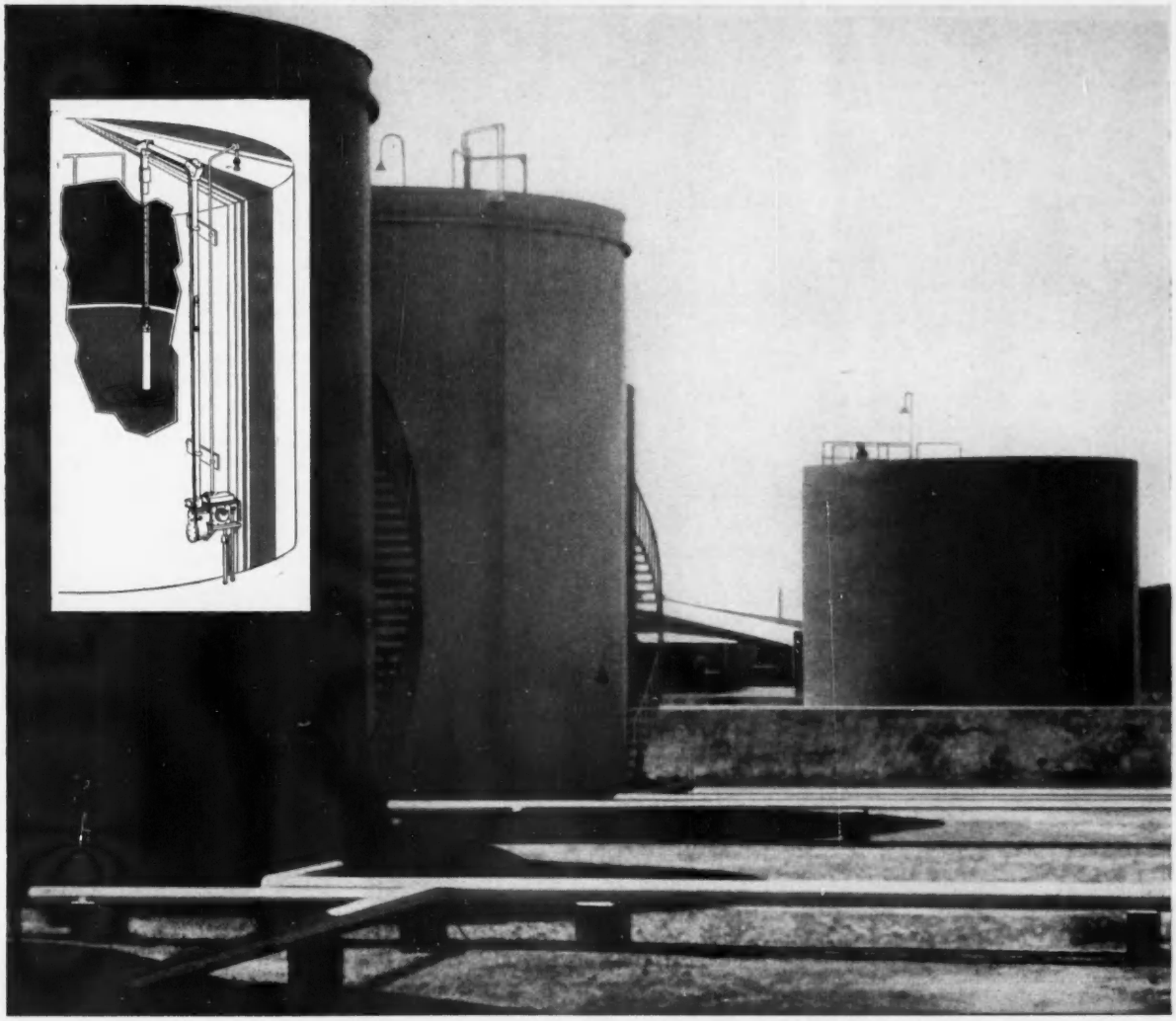
The melt-processible FEP resins now make available the established reliability of TEFLON resins in the form of long, continuous extruded lengths of wire and cable insulation and jacketing. It will pay you to evaluate the family of TEFLON resins as insulation for signal and control cable, thermocouple wire, hookup wire, heater cables and the like.

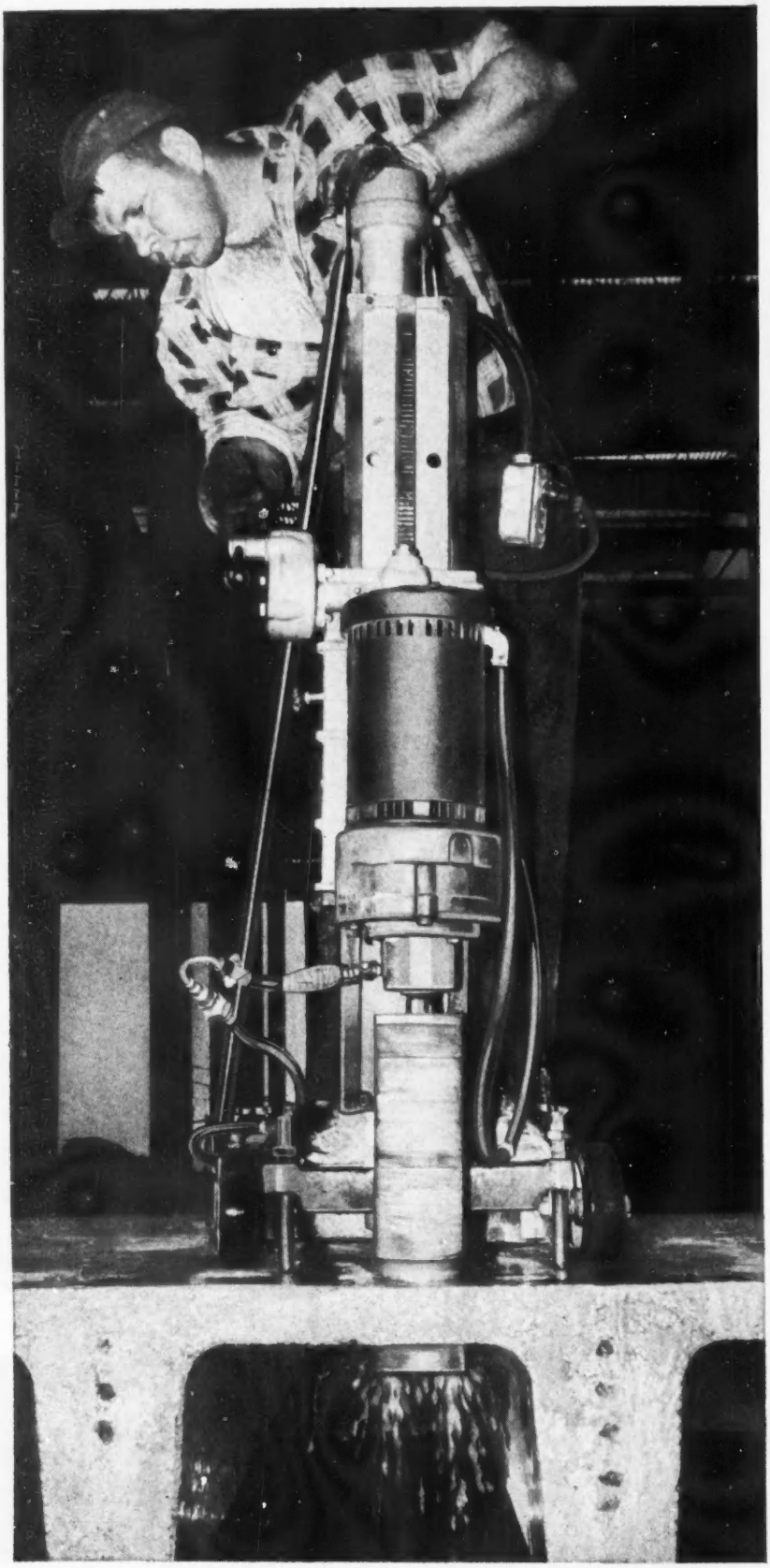
• • •

For more information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. EC-7, Room 2526T Nemours Building, Wilmington 98, Delaware. *In Canada:* Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.

DU PONT TEFLON®
REG. U.S. PAT. OFF.
FLUOROCARBON RESINS
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, fibers and film, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.





Drilling holes for steam pipes in Johnson County, Kansas, Hospital by Paragon Heating and Plumbing Co.

WORLD'S *FASTEST* CONCRETE DRILL

Fastest because it's the only drill with the adequate power necessary for low-cost drilling of any size hole up to 14" in diameter in heavily reinforced concrete — prestressed slabs—any masonry material.

G. E. designed the 3 H.P. induction type motor exclusively for Clipper—and designed it for heavy duty drilling under the most demanding conditions.

This gives the Clipper Core Drill superiority in speed and performance over units using converted hand drill motors. AND only Clipper gives you speed selection, 300, 800, 1500 RPM, to give you the right speed for every drilling job.

Write for complete information or CALL COLLECT to your Clipper Factory Trained Representative. He'll help you select the right Clipper drill for your next job and show you how to turn your worn out diamond bits into new Clipper Bits —at a savings.

Clipper
DRILLS RIGHT THRU

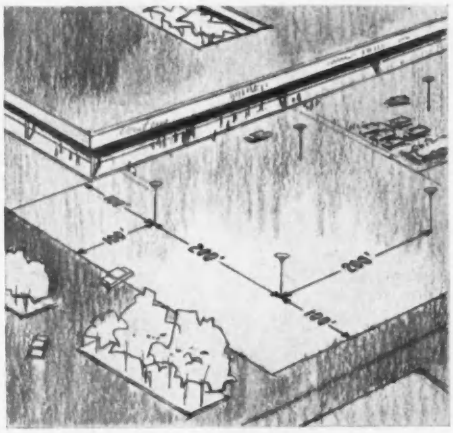
MANUFACTURING COMPANY
P.O. BOX 453, KANSAS CITY 8, MISSOURI

Factories: Australia, Brazil, England, France, Germany, Italy, U.S.A.

Sold Direct From Offices and Warehouses Coast to Coast

712X

Spectacular new Powerglow luminaire spreads light evenly over a full acre



MORE LIGHT WITH FEWER POLES is yours from the G-E Powerglow unit. 200-foot spacing and 35-foot mounting height put 2½ footcandles on the ground. A specially engineered reflector assures uniform distribution. The large acrylic globe diffuses light to reduce glare. Powerpack design includes ballasts in a completely unitized luminaire.

Now—in line with today's move to new higher lighting levels for shopping center lots—General Electric presents the spectacular Powerglow mercury luminaire and job-matched poles.

This new high-intensity unit delivers *4000 watts* of mercury light . . . spreads an average of 2½ footcandles uniformly over a *full acre*. Six feet in diameter—and available in five striking decorator colors—the Powerglow unit is a real eyecatcher . . . both day and night. It not only attracts customers . . . it helps put them in a buying mood!

For the most spectacular lighting we've ever seen—plus greater efficiency in lighting large areas—get acquainted today with the General Electric Powerglow mercury luminaire. Your local G-E Area Lighting Agent has full information on it, and the *full line* of G-E outdoor fixtures. Or, write for your copy of our new Shopping Center Lighting "Ideabook" to Section 460-18, General Electric Company, Schenectady 5, New York.

Outdoor Lighting Department, Hendersonville, North Carolina

Progress Is Our Most Important Product

GENERAL ELECTRIC

TOOLS THAT MAKE MORE MONEY!

ACTUAL SIZE
THE NEW POCKET SIZE TOOLS!
The rugged, light weight No. 607 Indentor for ½" fittings is shown here full size.

B-M { THE ORIGINAL INDENTOR TOOLS THE ORIGINAL INDENTOR FITTINGS

These are the tools and fittings that have revolutionized setting up thin wall conduit. B-M, the Original Indentor Tools have been working efficiently for over 25 years—doing more work easier and lowering installation costs. Now, B-M Indentors have been re-engineered and redesigned to reduce size and weight to increase efficiency and ease of operation. These B-M Indentors with the new patented compound leverage are now only plier size. They are lighter to carry, easier to use and the leverage does the work.

B-M, the Original Indentor Fittings go with B-M Indentor Tools like ham and eggs. Contractors who demand the best always call for the Original B-M Fittings for the soundest, most permanent installations possible. The fittings are concrete tight and vibration resistant. All steel, heavy gauge fittings are heavily bright zinc plated and have been salt spray and acid drip tested for corrosion resistance. Additional features are extra heavy bonding locknuts. Smoothly rounded edges or bushed throat type connectors make fishing easier and prevent damage to insulation.

For fast, safe installation plus complete protection always specify the Original B-M Indentor Fittings and the Original B-M Indentor Tools.

BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector

BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling

BM-51
½" Offset Connector
BM-52
¾" Offset Connector

BM PLIER SIZE INDENTORS
BM—No. 609 1" BM—No. 608 ¾"
BM—No. 607 ½"

BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

All B-M indentor type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

USED THE MOST FROM COAST TO COAST

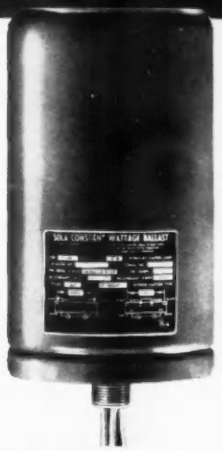
SOLA ANNOUNCES A NEW "DUAL 1000" 2-LAMP MERCURY-LIGHTING BALLAST!

S-7-62

New 2-lamp, 1000-watt ballast — parallel-lamp-operating, mercury lighting unit ideal for parking areas and other outdoor locations. Saves space, weight and work!

Low input-current demand of SOLA *constant-wattage design* during lamp starting allows more fixtures per circuit without stepping-up wire size or breaker capacity; also protects lamps against surge currents. No appreciable loss of light from good lamp when mate burns out. Fully self protecting against open or shorted lamps.

SOLA "Dual 1000" ballast comes preplanned for pole-base mounting — permits use of smaller pole-base than two single ballasts; alternately can be pole mounted with optional bracket. Order now through your SOLA dealer. Or write or phone directly for details on these and other SOLA mercury lamp ballasts, available in many types and ratings.



SOLA

DIVISION OF
BASIC PRODUCTS

"Dual 1000" Ballast Data

- Operates two Type H-15 or H-36 1000-watt mercury lamps.
- Constant-wattage design holds lumen output within ±2% for line-voltage changes as great as ±13%, assuring full rated lamp life.
- Prevents "drop-out" . . . input voltage must fall 30% below nominal before lamps extinguish.
- Primary — 105 to 135 v (120 v); or 210 to 270 v (240 v); 60 cy.
- Dimensions — 16" long; 9¼" OD. Recommended lamp position — vertical to 45° from vertical.

BP C

SOLA ELECTRIC CO.
1717 Busse Road,
Elk Grove Village, Ill.,
HEmpstead 9-2800
IN CANADA: Sola-Basic
Products Ltd.,
377 Evans Ave.,
Toronto 18, Ontario

REYNOLDS
INSULATED WIRE AND CABLE

BUILDING WIRE—SERVICE ENTRANCE CABLE

Aluminum or copper conductors; rubber or plastic insulations . . . a complete range of sizes and types to meet your specifications.

Reynolds now manufactures a complete range of insulated wire and cable products in new facilities at Chester, Penn. This modern plant has the latest wire drawing and insulating equipment. It is under the management of men who have brought about many innovations in the insulated wire and cable field.

Reynolds customers can draw on the talents of experienced engineers and technicians. Whether you're concerned with conductors, insulations, splicing, structures, fabrication—you'll find skilled personnel at Reynolds to help solve your problems. Reynolds new plant laboratory has a wide range of special test equipment, in addition to a complete inventory of standard testing machines.

Put Reynolds manpower and facilities to work with your engineering groups to get the maximum in cable and system designs. You'll find Reynolds, an integrated metal producer from mine to finished product, a company where new ideas take shape in better electrical products.

Now for Contractors and Distributors—More Products, More Services

Now Reynolds offers building wire and service cable in a complete range of sizes and types to meet your specifications. Aluminum or copper conductors; rubber or plastic insulations.

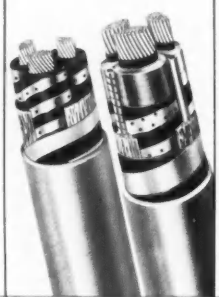
Reynolds building wire and cable is easy to install. It has excellent tensile strength, pulls through conduit easily, withstands abrasion. Its high dielectric strength, combined with physical toughness and resistance to aging, assures a long service life. Reynolds small diameter wire permits better utilization of available space in duct or conduit—an advantage when working in restricted space and when rewiring in existing raceway.

To accommodate the complex requirements of modern electrical projects, Reynolds Distributors stock a wide range of wire and cable products. Check your requirements with your nearest Reynolds Distributor. Or contact your Reynolds Sales Office, or write *Reynolds Metals Company, P. O. Box 2346-EX, Richmond 18, Virginia.*

Reynolds manufactures a complete range of electrical

MINING CABLE

CONTROL CABLE

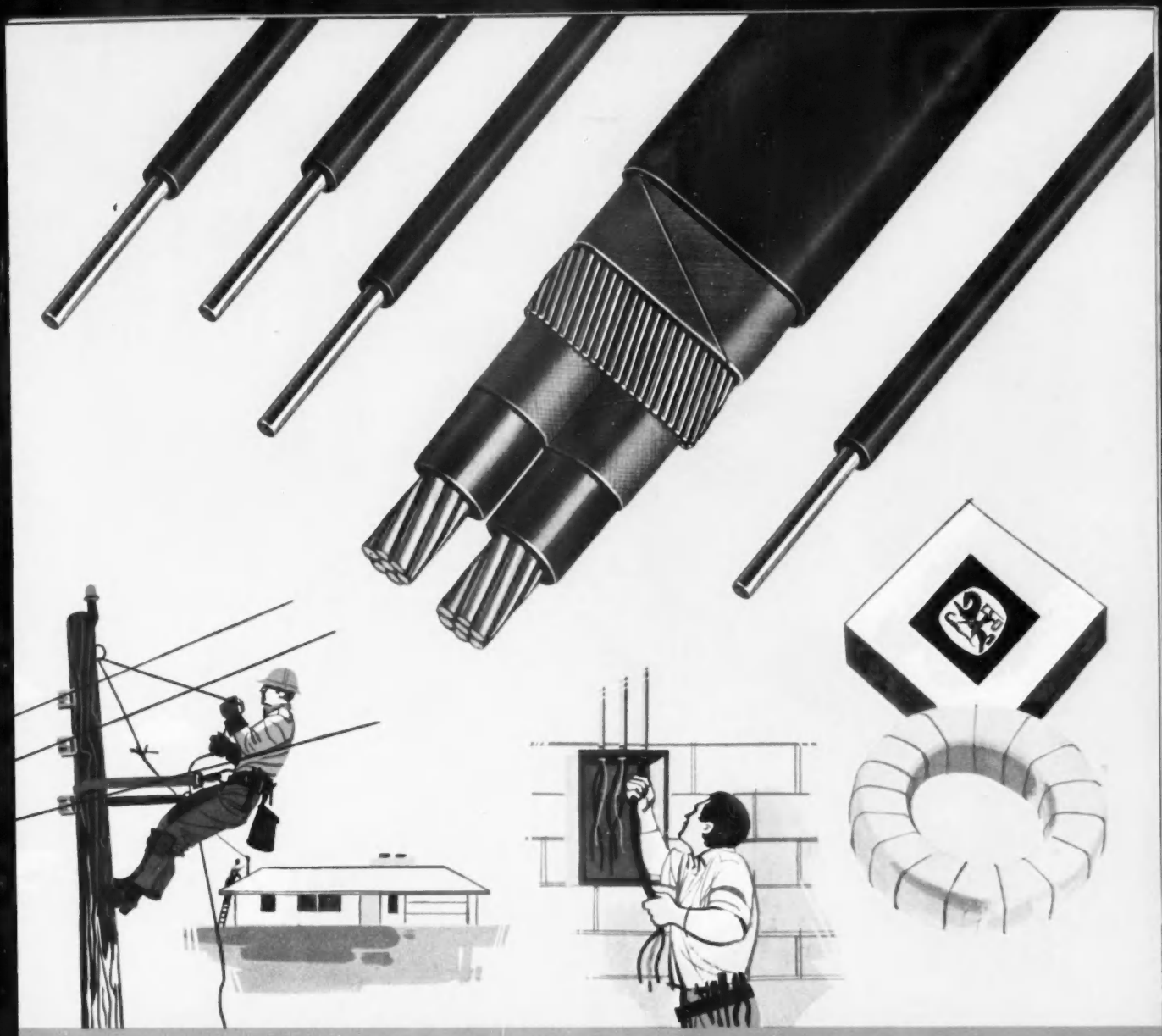


IMPREGNATED PAPER INSULATED CABLE—SOLID OR LOW PRESSURE GAS-FILLED TYPES

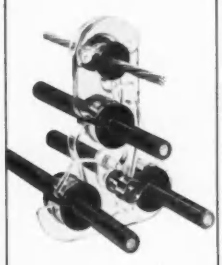
INTERLOCKED ARMORED CABLE

NETWORK AND POWER CABLES

REGULAR AND REVERSE LAY AERIAL CABLE



wire and cable . . . here are typical examples:



AERIAL CABLES AND SPACERS

MAGNET WIRE

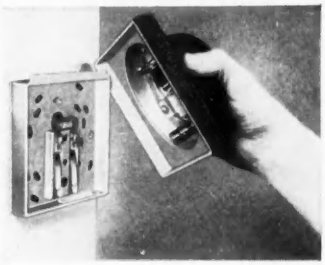
ACSR

ALL-ALUMINUM CONDUCTOR, EC AND HIGH STRENGTH ALLOYS

SERVICE DROP

SERVICE ENTRANCE CABLE AND BUILDING WIRE

"We Hooked it Up and Walked Away"



In the electrical signaling and communication industry this expression, coming from an electrical contractor, is the highest recommendation he can give of a manufacturer's equipment. It means "Well done! Your system installed easily and worked properly the first time. No rejects . . . no grounds or shorts . . . no trouble shooting, with all that means in running up the cost of a job. It worked like a charm!"

We're accustomed to hearing this expression quite frequently at Auth. Our equipment has always been designed to make installation easy. We give the contractor what he needs . . . wiring diagrams, equipment drawings, installation and operating instructions. All material is thoroughly tested before shipment.

Auth
SINCE 1892

We . . . at Auth. . . do this not only because it comes naturally. We do it because every time a contractor says to us "We hooked it up and walked away," we know that he'll be coming back to us on the next job. That's good will.

Manufacturers of
ELECTRICAL SIGNALING, TIME AND COMMUNICATION SYSTEMS FOR HOSPITALS, SCHOOLS, HOUSING, INDUSTRY AND SHIPS

Sold in cooperation with the distributor

Auth Electric Company, Inc.

LONG ISLAND CITY 1, NEW YORK

ROYAL
FIRST WITH THE MEN
WHO USE THE MOST
600 VOLTS
ROYAL ELECTRIC CORP
ROYAL
ELECTRIC
. . . an associate of
ITT
WIRE • CABLE • CORD SETS • FUSES • WIRING DEVICES
. . . because no other source of flexible and portable cord and cable makes the right construction so easy to get. For, the Royal family of quality products is reliably made, responsibly distributed, realistically priced, readily available.
ROYAL ELECTRIC CORPORATION, PAWTUCKET, RHODE ISLAND

ASCO low voltage Remote Control Switches decrease installation costs increase safety, permissible line run

ASCO Remote Control Switches equipped with *low voltage control* are suitable for 24 volt A-C control by push button, time switches, relays or other control methods.

ADVANTAGES

• ***REDUCTION IN COST OF INITIAL INSTALLATION:*** Control equipment can be connected through small wires – no BX or other large cable required. Control components such as push buttons can be inexpensive units: no conduit boxes are needed.

• ***SAFETY:*** Lower voltages provide increased safety for personnel. For schools or any installations where control stations are accessible to the public, the safety advantage of low voltage control is apparent.

• ***INCREASE IN PERMISSIBLE LINE RUN:*** Control wires can be #18 for a maximum distance between control station and switch of 500 feet; Maximum line run for #14 wire is 1300 feet.

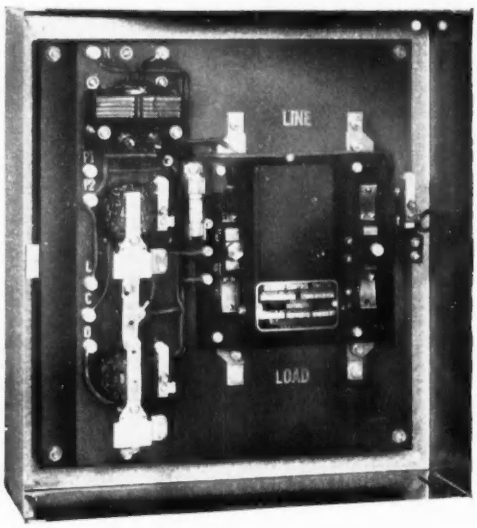
• ***ASCO "PACKAGE UNIT" REQUIRES NO EXTERNAL RELAY OR FUSE BOX:*** The Remote Control Switch, Relay, Transformer and Fuse – all the items needed for low voltage control – are on one compact panel.

• ***ADAPTABLE LOW VOLTAGE RELAY PANEL:*** Can be mounted separately from the Bulletin 920 Remote Control Switch. Relay panel includes low voltage control relays with a stepdown transformer.

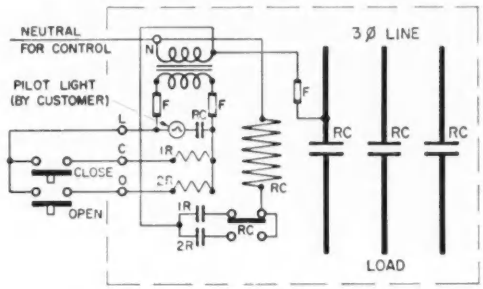
CONSTRUCTION AND OPERATION

Complete panel consists of a Bulletin 920 Switch with fuse adapter, auxiliary contact, and low voltage relay panel. In Circuit Diagram, control is shown from momentary contact control stations, using two normally open momentary contact buttons, one for closing and one for opening. Note that the push buttons are on the low voltage control circuit.

Additional openings and closing buttons can be connected in parallel with buttons shown.



Catalog No. 238SIC, 30 Ampere Bulletin 920 Remote Control Switch with Low Voltage Control.



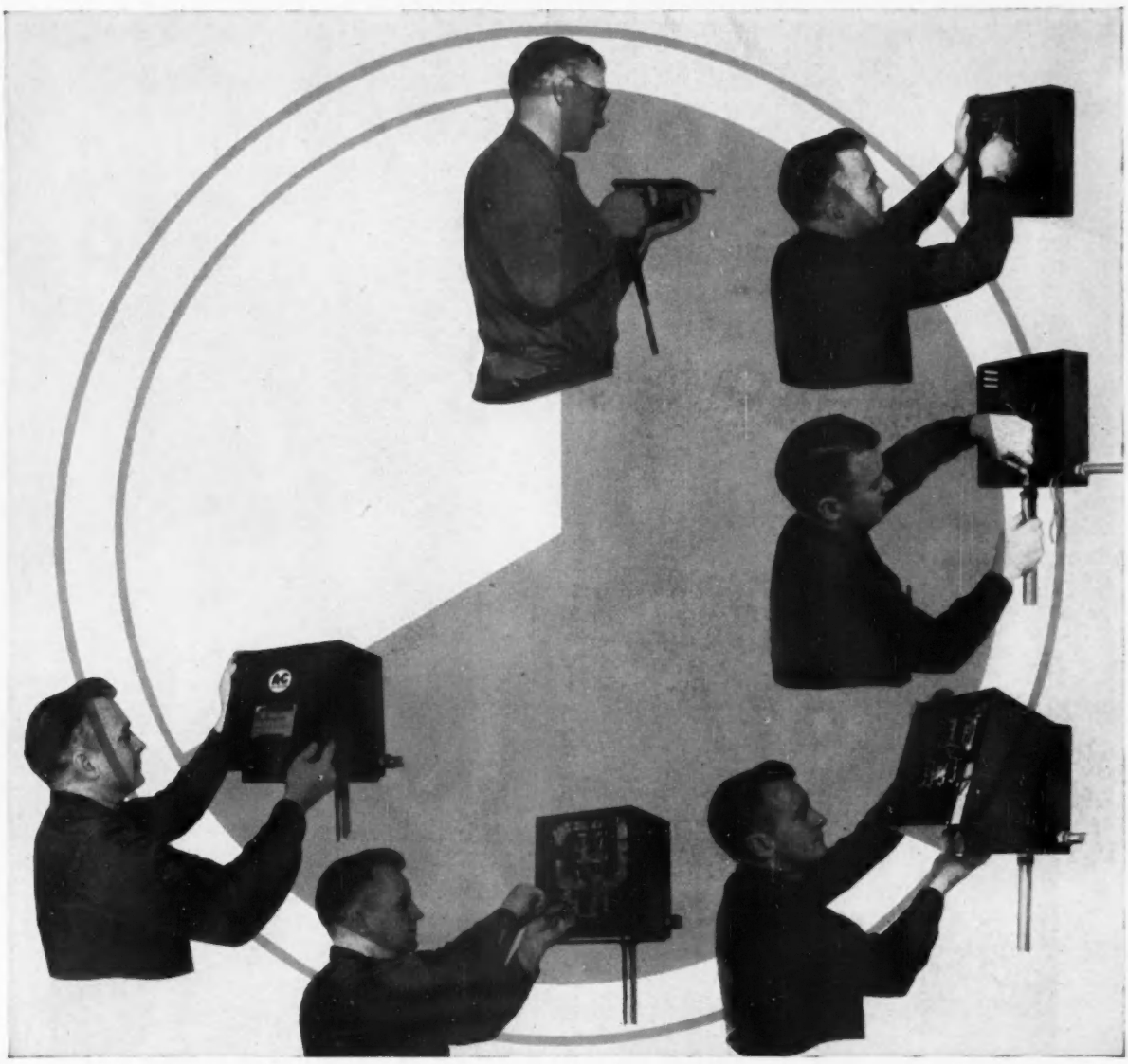
Elementary Wiring Diagram—Bulletin 920-238 Remote Control Switch for 24 Volt Low Voltage Control.

FOR COMPLETE INFORMATION, WRITE FOR BULLETIN 920-238 – OR HAVE THE ASCO ENGINEER CALL.

ASCO Electromagnetic Control

DEPENDABLE CONTROL BY Automatic Switch Co. 501 HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

ALLIS-CHALMERS



new 3-piece case dry-type transformer

installs in 40 minutes flat!

Electrical contractors, maintenance engineers profit from as much as a 50% savings in man-hours per A-C unit installed! They're 35% lighter and smaller than before . . . are on the wall, wired, closed in 40 minutes instead of the usual 90 minutes. That means *lowest finished-job costs,* more profits when you consider both cost of the unit and installing time!

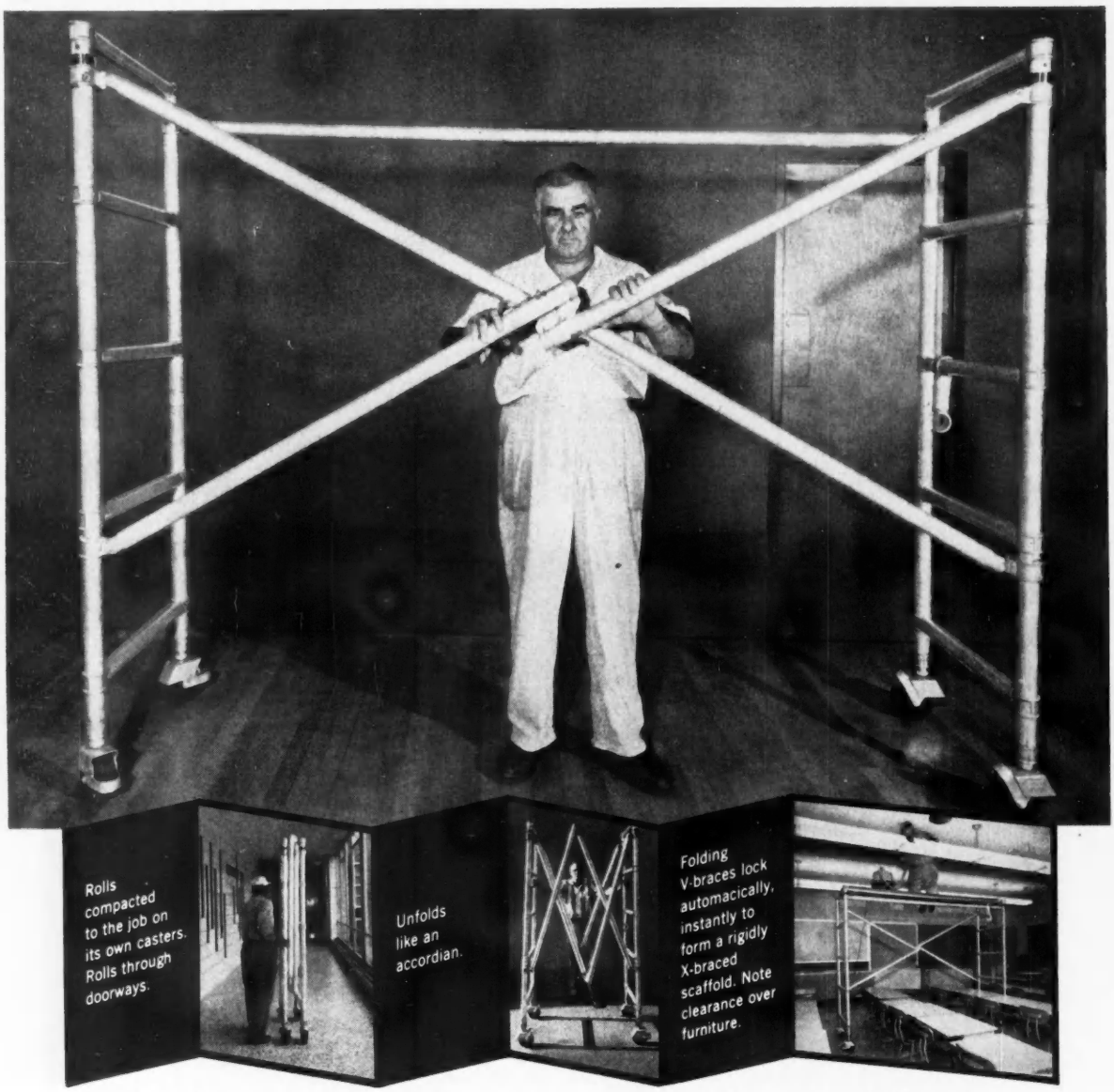
Thanks to this new simplified *3-piece case* design, common installation problems are eliminated. Convenient knockouts ease and speed hookup. Conduit bending is reduced or eliminated. Compact size means A-C units will go where conventional dry-types are squeezed out.

And these new units are whisper-quiet. Every known silencing factor is incorporated into this design . . . core impregnation . . . core and coil assembly isolated from case . . . and nonresonate casing is used.

• • •

This new dry-type, ventilated transformer line (600-volt class, indoor) is offered in 10 sizes, from 3 to 45 kva. *Your nearby A-C office will supply you with free Bulletin No. 61 B 8222C, or write Allis-Chalmers, Milwaukee 1, Wisconsin.* A-1601

New one-piece scaffold unfolds and locks into shape in 10 seconds!


Rolls compacted to the job on its own casters. Rolls through doorways.
Unfolds like an accordian.
Folding V-braces lock automacically, instantly to form a rigidly X-braced scaffold. Note clearance over furniture.

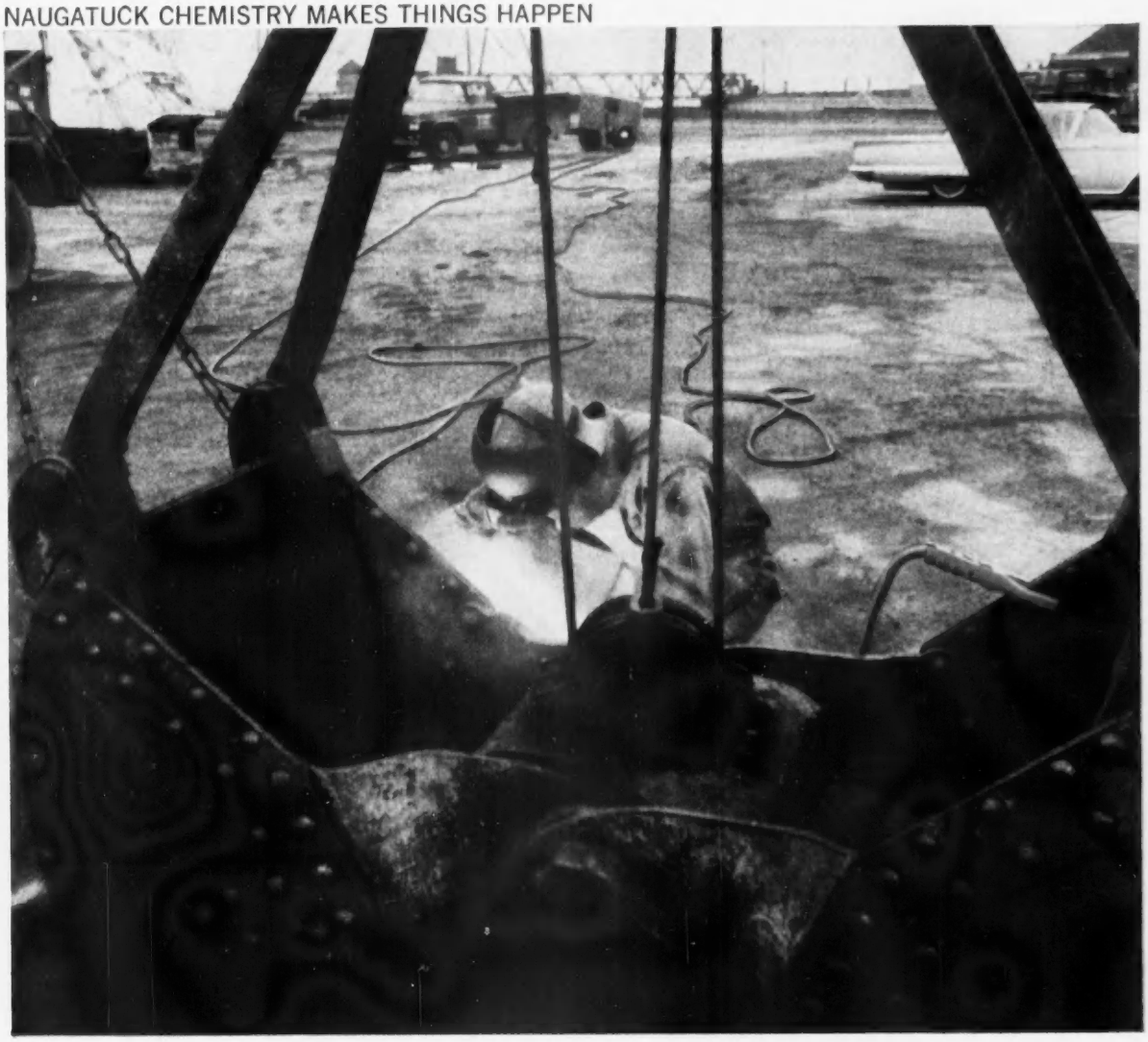
No tools required. No nuts, bolts, loose parts—nothing can be left out or lost! Platform height adjustable from 1 ft. to 8½ ft. Instantly adjustable legs. Lightweight aluminum: can be carried up stairs by 1 man. Compact: stores in same space as a step ladder. Interchangeable with all Up-Right span scaffolds in use.

UP-RIGHT

ALUMINUM **VX** SCAFFOLD

Write for circular: **UP-RIGHT SCAFFOLDS, Dept. 104, 1013 Pardee, Berkeley, Calif.**

NAUGATUCK CHEMISTRY MAKES THINGS HAPPEN



Look what's new in welding cable!

PARACRIL OZO Nobody wants to trip over or accidentally cut an electric cable. A welding cable, particularly, carries a potential hazard at the business end, a high amperage, and a loss of dollars if service is interrupted.

Carol Cable Company of Pawtucket, Rhode Island, found an excellent solution to this constant hazard by jacketing its cable with tough, colorful PARACRIL® OZO. (Carol calls it VU-TRON 7.) The brightest, *lasting*, orange color calls instant attention to the cable even amid a profusion of other hose and cables such as found on a construction site. What's more, this unique blend of nitrile rubber and vinyl gives far superior resistance to attack from weather, ozone, oils and other solvents, and has outstanding resistance to cutting and abrasion. These new cables actually have five times the abrasion resistance of standard synthetic rubber after being exposed to oil! They're more flexible, too.

In short, PARACRIL OZO makes good welding cable better—safer, more durable than ever. And there's a good chance it can improve your product as well. If you'd like to combine toughness, oil and chemical resistance, and excellent color retention, check with your Naugatuck Chemical representative today.

Naugatuck Chemical

DIVISION OF UNITED STATES RUBBER COMPANY...DEPT. 734PA ELM ST., NAUGATUCK, CONN.

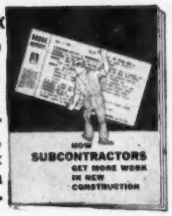
US RUBBER

DIST. OFFICES: Akron · Boston · Chicago · Gastonia · Los Angeles · Dallas · New Brunswick, N. J. · **CANADA:** Naugatuck Chemicals, Elmira, Ont. · **CABLE:** Rubexport, N.Y.

Dodge puts you on the inside track to profitable jobs

Electrical contractors can move ahead of competition by using Dodge Reports. Dodge gives you inside information in advance about new construction bidding opportunities in your area. Gives you details every day on new jobs you want to go after — just the type, size and location you specify. Lets you concentrate on the business that looks best to you, leave the rest to your competitors who don't have this advantage. To get the full details on Dodge Reports return this coupon today.

ELECTRICAL CONTRACTORS! — WRITE FOR FREE BOOK



F. W. Dodge Corporation
Construction News & Statistics Div.,
Dept. ECM72, 119 W. 40th St., N.Y. 18, N.Y.

I'd like to receive your free booklet, "How Subcontractors Get More Work in New Construction" and details on how Dodge Reports can help me increase volume and profits.

Name _____

Company _____ Title _____

Address _____

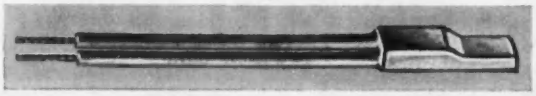
City _____ Zone _____ State _____

F. W. DODGE CORPORATION **DODGE reports**

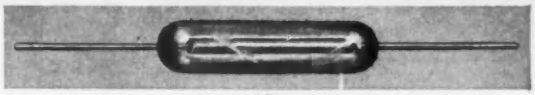
ADVAN-guard® is a thermally actuated automatic reclosing protective device sealed in the ballast housing. It is sensitive to voltage and current as well as temperature and protects against excessive voltage supply . . . internal ballast short circuiting . . . inadequate lamp maintenance . . . improper fixture application and eliminates the need for individual fixture fusing.

ADVAN-guard® is preset to trip out automatically whenever the Fluorescent Lamp Ballast operates at abnormal temperatures. When heat decreases to normal operating temperatures, ADVAN-guard® resets automatically and the ballast resumes normal operation. Through this continuous protection the full life of ADVAN-guard® Fluorescent Lamp Ballasts is realized. Only ADVAN-guard® ends premature destruction and unnecessary replacement labor costs.

AUTOMATIC RE-SETTING
ADVAN guard®
THERMAL PROTECTION



ADVANCE OFFERS A CHOICE OF BALLAST PROTECTION



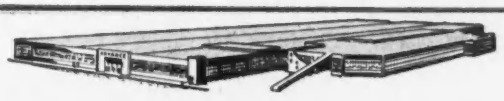
EQUIPPED WITH NON-RESET
FUSE LINK
THERMAL PROTECTOR

Advance FUSE-LINK is a temperature sensitive non-resetting protector built into the fluorescent lamp ballast. It is sensitive to heat and designed to open when the ballast is subjected to high temperature from any internal or external cause. The capacitor utilized in the FUSE-LINK ballast line also incorporates a thermal link which will open whenever the capacitor is subjected to abnormally high temperatures.

FUSE-LINK Fluorescent Lamp Ballasts protect against ballast leakage and end-of-life hazards. When a condition occurs that causes either or both links to open . . . the ballast is destroyed and must be replaced.

That's the protection story, ADVANCE offers a choice! Your ADVANCE Sales Engineer will be happy to help you make that choice. Call him or write today.

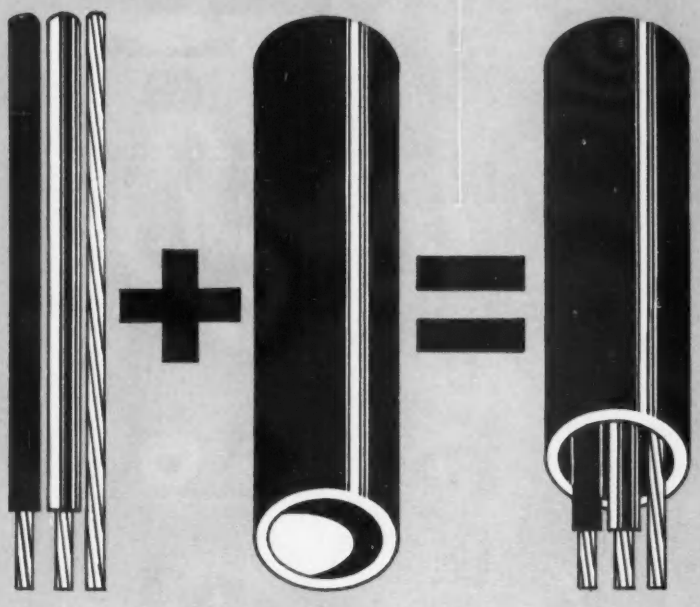
"The Heart of the Lighting Industry."



ADVANCE TRANSFORMER CO.
WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS
2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

click, click, click,

TRIANGLE UNIT TYPE DUCT-CABLE SYSTEM



A COMPLETE, PRE-ASSEMBLED UNDERGROUND STREET LIGHTING CIRCUIT... ALREADY ENCLOSED IN PLASTIC DUCT!

BIG SAVINGS IN TRANSPORTATION... TRENCHING... INSTALLATION

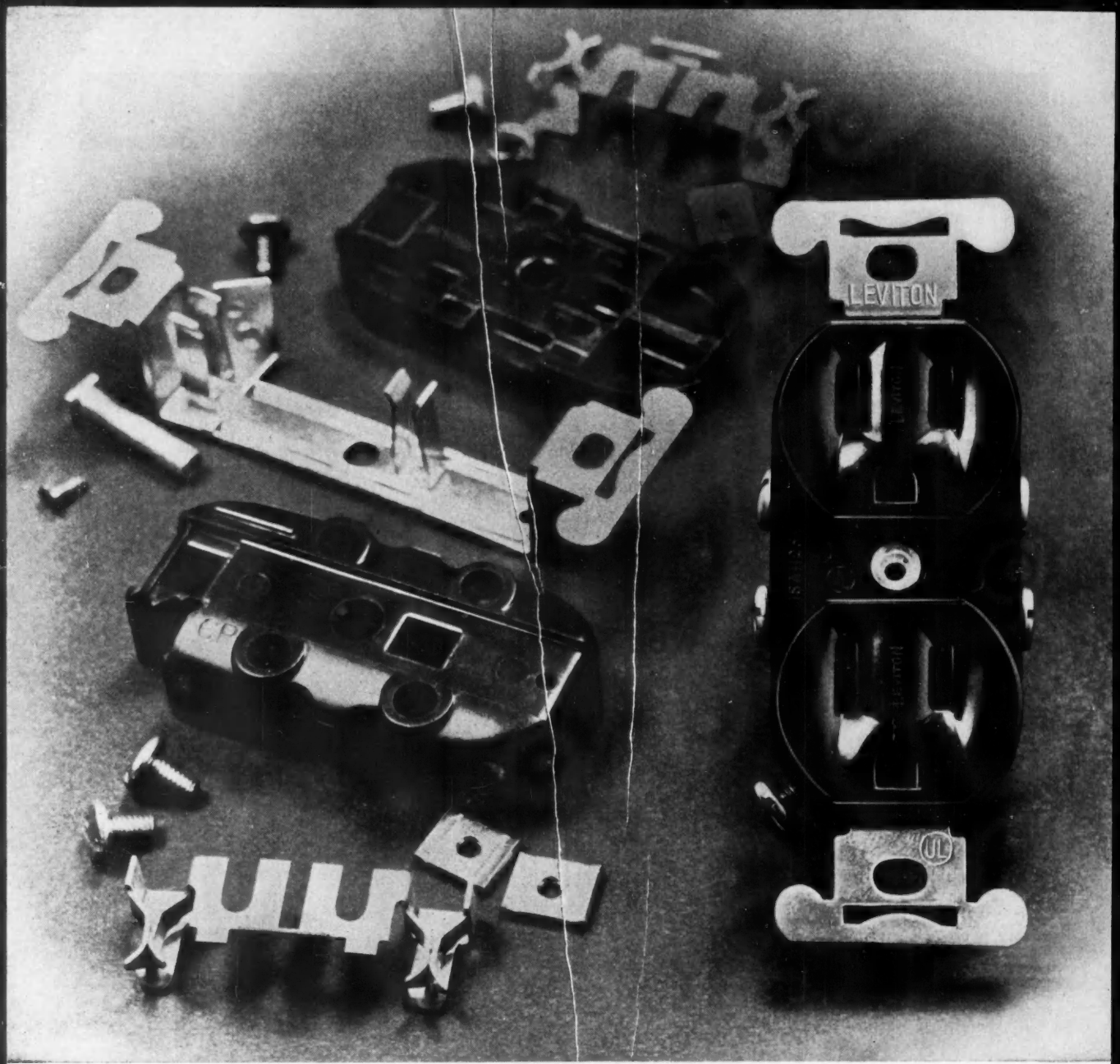
Triangle's Unit Type Duct-Cable System has been designed and engineered to overcome the disadvantages of the installation of duct in short lengths with sleeve type couplings. Triangle's method provides a vastly superior system at considerably lower cost through the use of a "UNIT ASSEMBLY" consisting of the required number of parallel conductors in long length coilable plastic duct on reels.

- **Easier To Transport**—No separate units to be transported and assembled but a complete system, ready for installation.
- **Easier To Trench**—There's no need to work in the trench, therefore only a small slot trench is required. Or, just plow the system in.
- **Easier To Install**—Duct need not be straightened too much, since some snaking is necessary to accommodate expansion and contraction. This system eliminates use of fish wire, splice boxes and fittings to meet changes in route and profile. Eliminates the necessity for sand bedding, protective planking or other precautions normally required for direct burial cable.
- **High Impact Strength**—Withstands heavy pounding of overhead traffic, severe abuse by hand tools such as shovels and picks.

For complete Technical information on the Triangle Unit Type Duct-Cable System, write:

WIRE AND CABLE DIVISION
TRIANGLE CONDUIT & CABLE CO., INC.
NEW BRUNSWICK, NEW JERSEY

"It MUST Be Right!"



DON'T TAKE OUR WORD FOR IT

Make the comparison test and find out for yourself. We'll match our quality with any other line on the market today selling at a higher price. Ours costs less, yes—but without any sacrifice of quality, performance or durability! How do we do it? We start from scratch with the raw materials needed to produce all the components that go into our product. Production of this rigidly tested product takes place on the most advanced, automated equipment available. Result: Basic economies! Take our product and a competitive one and pry them apart. Examine them, checking each part carefully against the other. See what we mean? Now check your price lists. That's where Leviton wins hands down. Don't you owe yourself this comparison test? ■ Write to Dept. EC1 for a free sample and see for yourself. It can only save you money. **Leviton Manufacturing Co., Inc., Brooklyn 22, New York.**

LEVITON®

THE MAXIMUM PERFORMANCE PRODUCT

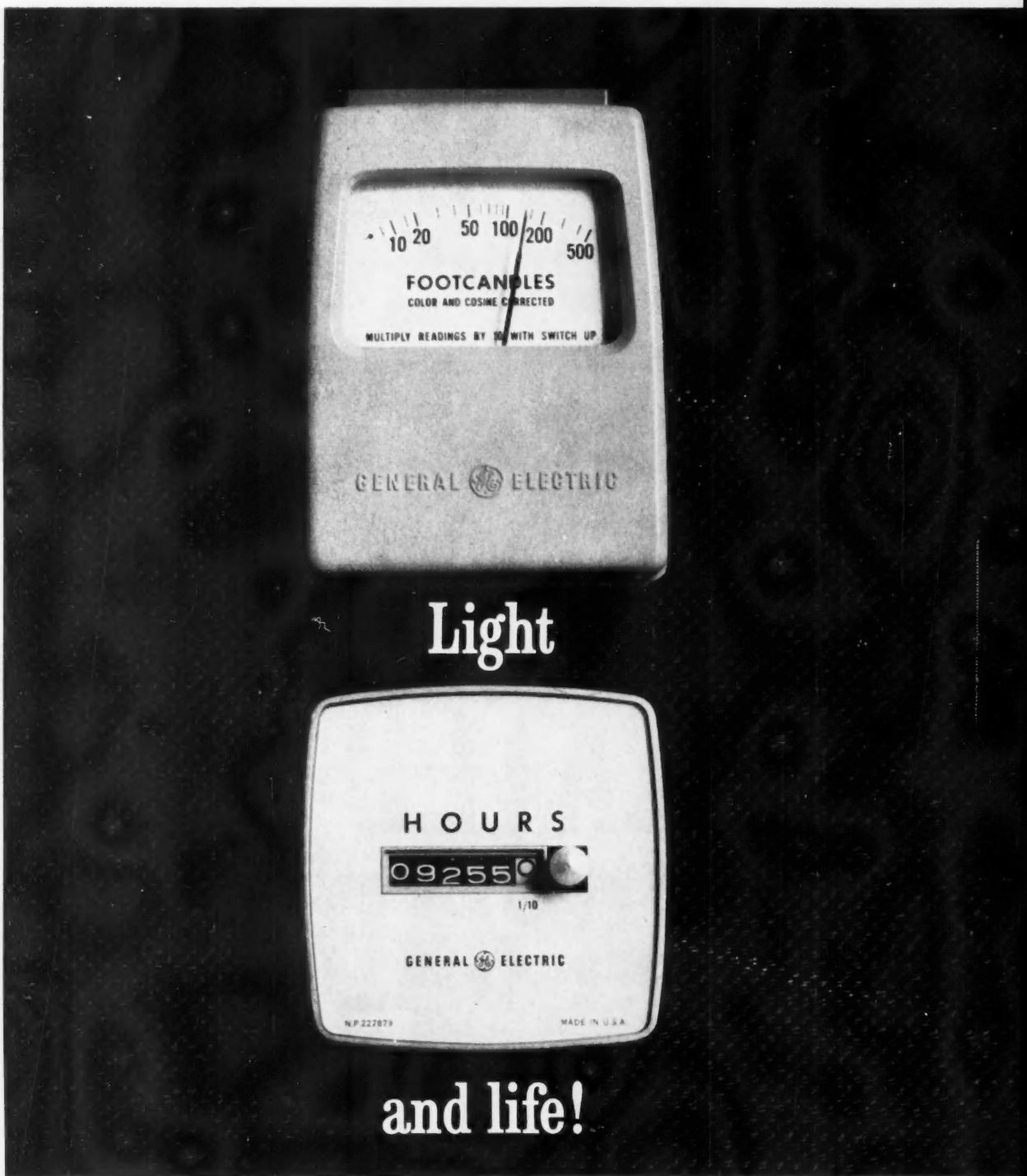
NOW IN SERVICE OVER 600,000 FT. OF SIMPLEX POLYETHYLENE INSULATED POWER CABLE

Voltages from 15 KV to 46 KV

In installation after installation Simplex high voltage polyethylene-insulated power cable has proved itself to be a truly superior product. It combines the advantages of low dielectric loss with high dielectric strength and very high insulation resistance. And it retains these properties under service conditions. Typical applications include direct burial, duct or conduit, aerial and submarine. Write today for complete information.

POLYETHYLENE CABLES BY Simplex WIRE & CABLE CO.

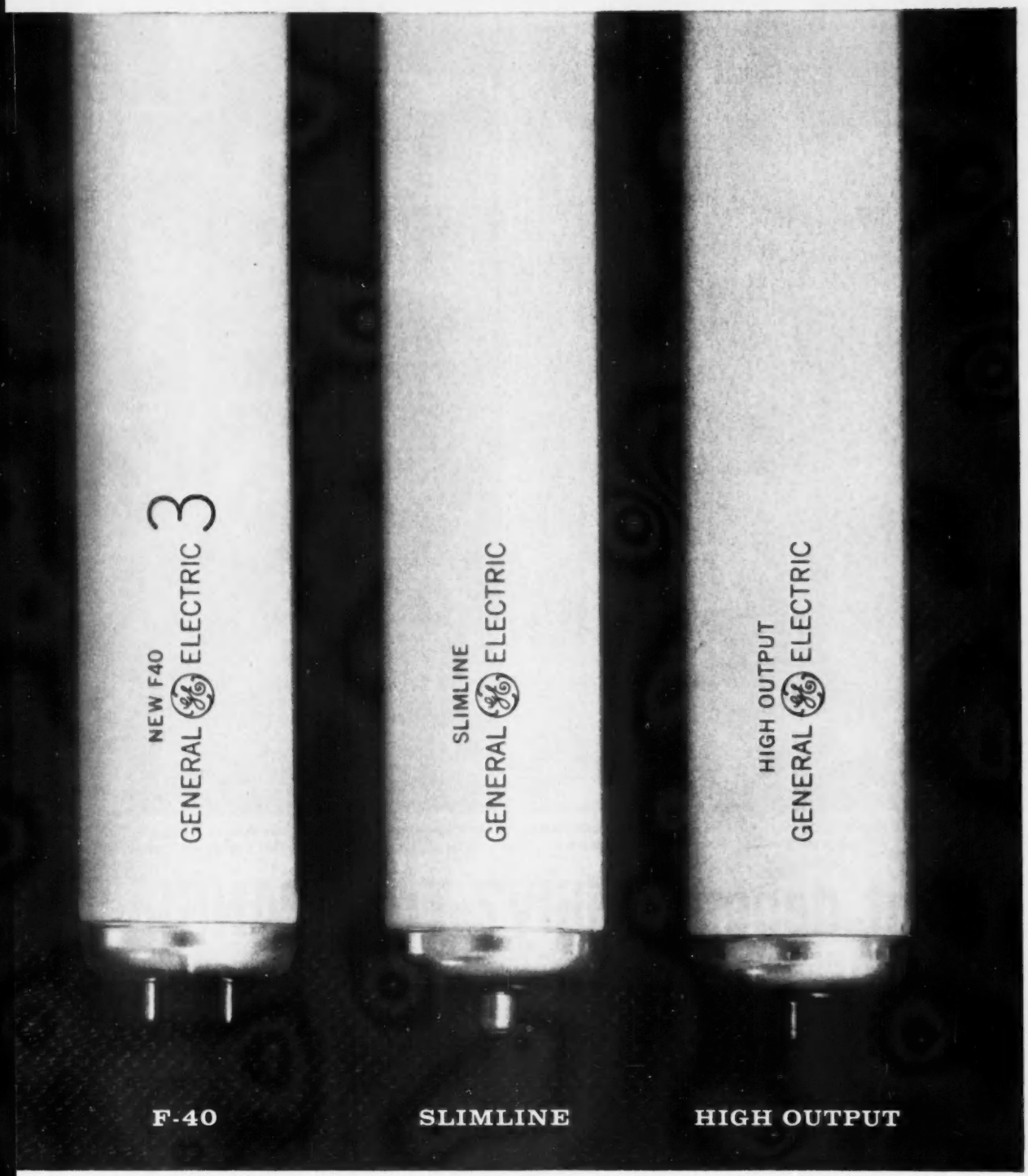
EXECUTIVE OFFICES: Cambridge, Mass. • Plants at Cambridge, Mass., Portsmouth, N. H., Westbury, L. I., Monrovia, Calif.



GENERAL ELECTRIC GIVES YOUR CUSTOMERS BETTER LIGHT AND LIFE— in more standard fluorescent lamps than any other manufacturer. What's it mean to them? Just this. Every time your customers buy a General Electric lamp, they are certain to get important added light. Your customers' lighting system will operate at its most efficient, most economical level. For facts to demonstrate all of these new developments in lighting, call or see a General Electric Large Lamp distributor or write General Electric Company, Large Lamp Department C-215, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

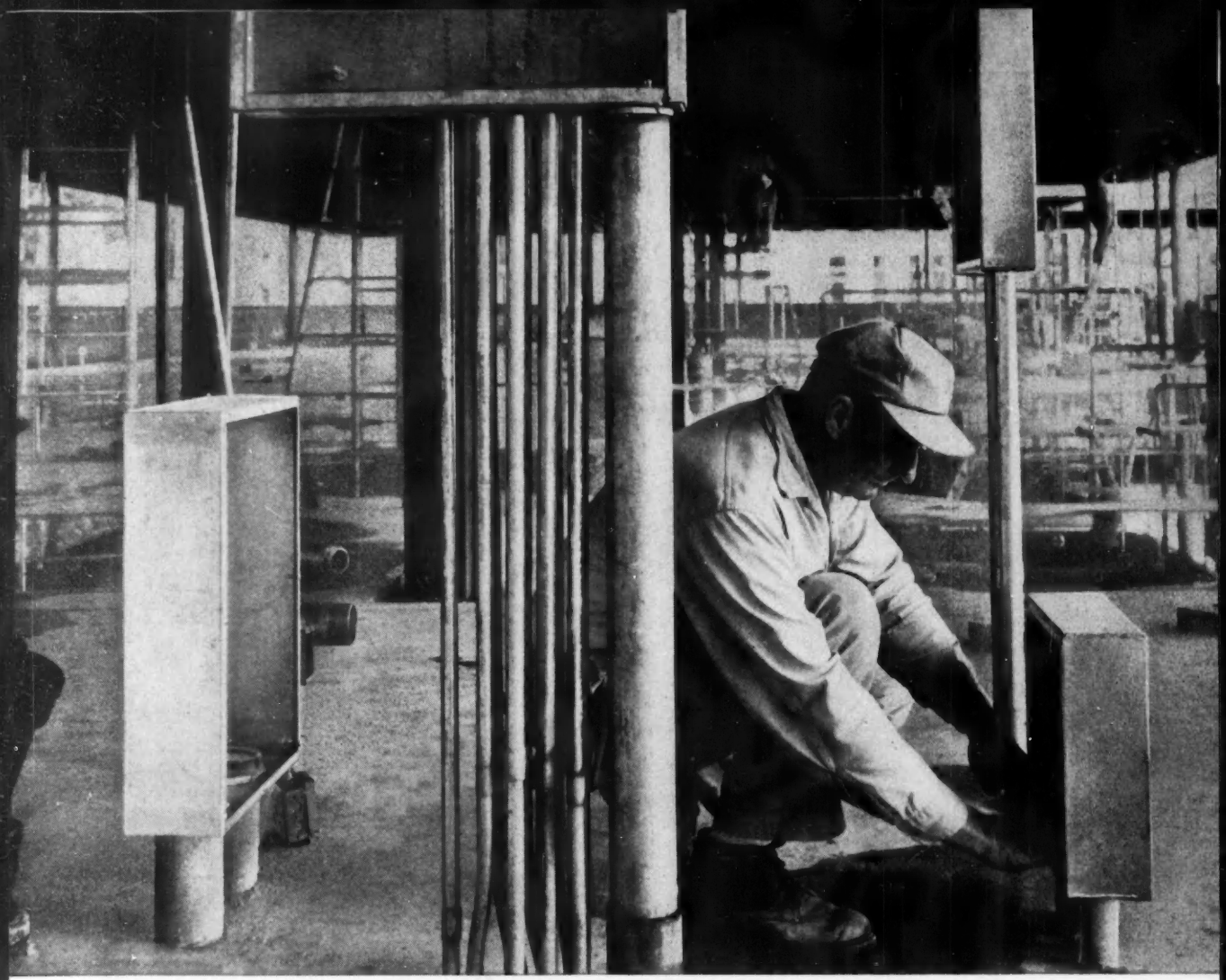
GENERAL ELECTRIC



YOUR CUSTOMERS GET THE MOST LIGHT in a standard 40-watt fluorescent from the New General Electric F40. It doesn't cost a penny extra, and in newer systems lasts as long as any other lamp. Pre-1954 systems also get the most light from the New F40, which most people prefer. For those who emphasize life in older systems, G. E. has the answer, too: The F40/54, giving as much or more light and life as any lamp for this service.

MORE LIGHT for your customers' dollar is now available from G-E Slimline fluorescent lamps. Again G. E. leads the industry in raising the standard of lumen levels—5% more at no increase in cost. Combined with improved life ratings, this extra light that your customers now get from G-E Slimline lamps gives still another reason it pays to get the fluorescent lamps with the highest performance levels—lamps made by General Electric.

EVEN MORE LIGHT and longer life ratings from still another fluorescent. Now General Electric adds new, higher lumen output to the new life ratings of High Output fluorescent lamps. It's still another example of how G-E lighting leadership pays your customers a profit every time they install lamps bearing the General Electric trademark. It's another reason you owe it to your customers and yourself to get all the facts on G-E lamps.



More than 65,000 ft. of SPANG Steel Conduit is installed in the new $2,000,000 St. Mary's Dominican High School, New Orleans, Louisiana. Conduit will protect wiring for general lighting, phones, air conditioning and electric heating, television, commercial system and clocks.

Want dependability? Try SPANG®!

You'll get it all the way—from on-time delivery to trouble-free installation.

Take the case of Lindsey & Morgan, the New Orleans electrical construction company that installed 65,000 ft. of SPANG Steel Conduit, made by Armco, at St. Mary's Dominican High School. Here's how L & M Partner Ralph Morgan ticked off the SPANG-dependability on this job:

- Conduit at the job site ahead of schedule.
- Bundled in steel strapping for easy handling, no bent lengths.
- Color-coded thread protectors for fast identification.
- Uniform product made for easy cutting, bending and threading.
- Smooth interior finish facilitated wire-pulling.
- Makes good appearance in exposed locations.
- All threads were in "go" condition despite long outdoor storage of some bundles.

Dependability? Yes, indeed! For this reason alone, Lindsey & Morgan uses Armco's SPANG Conduit regularly. And so should you. See your local SPANG Distributor.

For more information, write *Armco Steel Corporation, Armco Division, Middletown, Ohio.*

Architect: Philip P. Cazalé, A.I.A., New Orleans

Consulting Electrical Engineers: Guillot, Sullivan & Vogt, New Orleans

General Contractor: Perrilliat-Rickey Construction Co., Inc., New Orleans

Electrical Contractor: Lindsey & Morgan, New Orleans

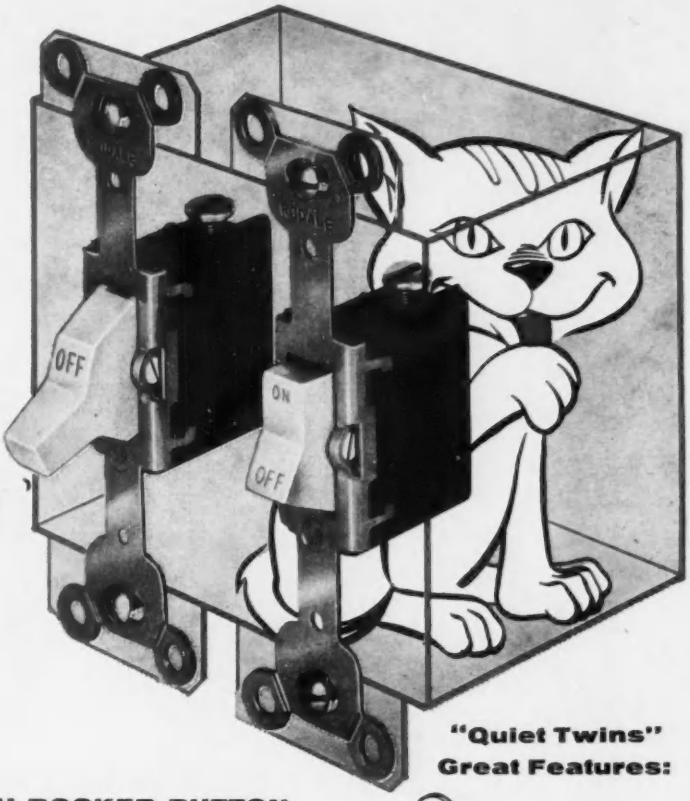
SPANG Distributor: Woodward, Wight & Co., Ltd., New Orleans

ARMCO **Armco Division**

THE STRONG

Quiet Twins®

so small you can throw an Alley Cat in the Wall Box along with them...



"Quiet Twins" Great Features:

AVAILABLE WITH ROCKER BUTTON OR STANDARD TOGGLE

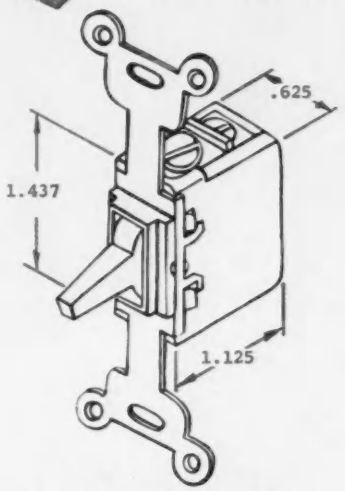
Through extensive and timely engineering research, RODALE QUIET TWINS now employ an exclusive principle (patent applied for) which assures longer switch life and smoother, quieter operation.

It is this very principle which makes possible the uniquely *small* SIZE of the body.

Amazing ... the ease with which these quiet switches are installed. The diminutive size of the switch body leaves more room all around for bulky wires.

Another easy installation feature... the heavy steel mounting straps are delivered with mounting screws already in place. *Quiet operation is achieved without the use of rubber pads which can deteriorate silver alloy contacts.* Eliminating this objectionable characteristic has greatly added to the life of the switch and improves the firm, quiet operation.

Rodale's silver alloy contacts are life lasting and assure the best circuit completion possible.



- *Smallest Quiet Switches*
- *Firm, silent operation*
- *Life Lasting silver alloy contacts*
- *No possible deterioration due to chemical reaction with rubber bumpers*
- *Available in brown or ivory*

Rated 15 Amps., 120-277 Volts A. C. only ... available in Single Pole and Three Way... UL and CSA Approved... 100% factory inspected and tested.

A RODALE EXTRA VALUE FEATURE

For ease in properly aligning switches when multiple gang installations are involved, Rodale has designed the "Switch Locator" template. This template is simply placed over the switch buttons. The slots hold the switches in proper position while the strap screws are being tightened to assure a perfect wall plate fit the first time. Every package of ten switches includes a "Switch Locator". These templates are also available for the asking direct from Rodale.

Sold only through electrical wholesalers, or for further information and prices, write Rodale direct.

Rodale manufacturing co., inc.
dept. L-1, emmaus, pa.

LOOK FOR THE PURPLE LINING THAT MEANS TWO-WAY SAVINGS

1. FASTER, EASIER PULLS: the purple lining means Kaiser KINGFISHER is the only conduit with K-40 silicone . . . the specially developed smooth, hard inner lining that lets cables slip past bends up to 61% easier!†

2. KAISER ALUMINUM'S EXTRAS: this exclusive purple lining also tells you that Kaiser KINGFISHER is the only conduit that saves time and money with: aluminum's light weight, easy threading, uniform bending, and high strength forged couplings.

Only competitively priced Kaiser KINGFISHER has all the advantages of aluminum plus slick K-40 silicone lining. Cut installation costs on your jobs: look for the purple lining and get two-way savings . . . from your authorized Kaiser KINGFISHER Distributor.

† Pull required after fourth bend in standard test comparing other lined and unlined conduits including steel: using 3 #2RHW cables in 1¼" conduit.
* Trademark of Kaiser Aluminum & Chemical Corporation.

KAISER ALUMINUM

See "FOLLOW THE SUN" weekly, ABC-TV Network

61ST YEAR • JULY 1962

ELECTRICAL CONSTRUCTION AND MAINTENANCE

New Manpower Needed

If the more cosmic current crises in the economy, like the profit squeeze and the jittery stock market, can be brought into check, we can expect a better-than-average gain in electrical work for the months ahead. Over recent years electrical construction activity has enjoyed healthy advances resulting from the happy coincidence of steady construction volume and persistent growth in electrical utilization.

Skilled manpower supply, however, is not keeping pace. At some time in the near future a point inevitably will be reached where inadequate manpower availability may become a critical restraint on the industry's capacity to serve a growing market. Some say we have already passed that point. It is estimated that the number of skilled electricians available is increasing at about half the rate of growth of the market as a whole.

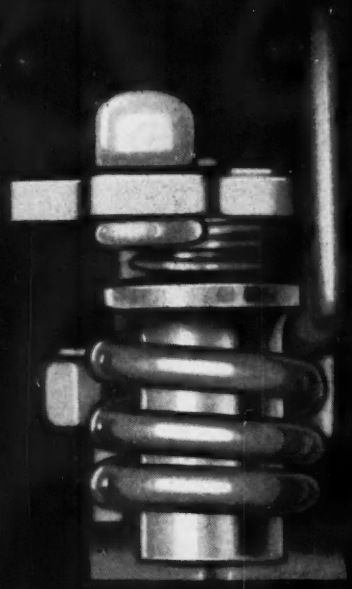
Some unbalance in the rate of recruitment of new hands is tolerable. Electrical construction technology has been adopting increasingly sophisticated systems involving fewer on-site installation labor-hours per kilowatt of capability. Special scaffolding and tooling, and particularly power tooling and mechanical materials handling, have greatly extended the effectiveness of the individual man-hour. Modern management methods of job planning, work allocation and supervision have also improved efficiency.

But for the long range a consistent, deliberate program designed to recruit superior young men for the craft is vitally essential. Numbers are not enough. We should be looking for the most talented of the crop while they are still in school or in military service. They should be followed individually and encouraged to select a career in the electrical construction industry.

Present apprenticeship projects are effective to a degree. But they are oriented to screening applicants and administering a rigidly established training schedule. Few, if any, are engaged in an active recruitment program aimed toward enlisting young men of superior potential.

Besides elementary job manpower needs there is another aspect of recruitment that deserves careful consideration. Most of the middle management and technical specialist jobs in electrical construction are filled from the ranks. The people who plan and direct at the practical level are a vital force in any organization. In 10 to 15 years these key jobs will be passing to the men we are recruiting today. Let's be sure they are the cream of the crop.

Wm. T. Stuart



COIL PROTECTION! . . . . . STOPS SHORT CIRCUIT DAMAGE INSTANTLY. BULLDOG PUSHMATIC® CIRCUIT BREAKERS HAVE MULTI-TURN COILS FOR INSTANTANEOUS MAGNETIC ACTION. BUY PUSHMATIC QUALITY . . . BUY CUSTOMER PROTECTION. CONTACT YOUR I-T-E DISTRIBUTOR OR LOCAL I-T-E SALES OFFICE TODAY.

Write for your copy of
"The Story Behind the Ad"

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

1962 TOOLS AND METHODS REPORT

Practical Ideas To Cut Installation Costs

How contractors apply modern tools and time-saving techniques to lower installation costs of electrical projects. A review of field practices adaptable to a wide variety of job conditions.

CONTENTS

Material Handling	89	Underground Work	116
Scaffolding and Platforms	94	Pole and Line Work	120
Fastenings and Supports	98	Temporary Power Facilities	124
Assembly Techniques	103	Alteration Work	126
Conduit and Raceways	108	Job Communication	130
Cable Handling	112	Tools for Maintenance	132

ELECTRICAL construction technology has been called the keystone to profits by many successful electrical contractors. Basically, it involves comprehensive knowledge and understanding of the various factors involved in a construction project: field engineering; cooperation between trades; job conditions; manpower management; installation techniques; job tooling and mechanization. Perhaps the most significant of these has been the progressive use of power tools and time-saving methods to supplement the skills of a fairly static manpower pool.

Experienced contractors have learned the value of more and better job tooling; of more highly organized field crews; of time-saving material handling methods; of a mechanized, production-line approach to highly repetitive operations. This has helped them keep pace with the increased use of electrical energy and with a growing demand for their services in a highly competitive field. In fact, many consider this the one area in which they can maintain some measure of control over the progress of an electrical construction project. Others attribute their fortunate competitive position to tool-conscious management and field-oriented estimators.

Today, the electrical construction industry faces a similar situation. Wage rates are being increased and pressure is being exerted for a shorter work day. Labor contracts in two large cities have established hourly rates in the $5 range and work days less than the 8-hour standard. These may well set a pattern. The number of skilled mechanics available is about the same as in the past.

Although apprentice training is in full swing, the net effect on an over-all increase in the skilled labor pool may not be too significant. A four-year work and study program separates apprentices from Class A journeymen status. By the time they complete their training, the number of apprentices may be slightly more than that required to cover normal skilled labor attrition (loss by retirement, death, etc.). At the same time, continued advances in the electrical industry bring more applications of electrical energy, more complex systems and controls, more need for installation and maintenance man-hours. The obvious answer is a "painless" increase in manpower productivity through the continued and improved use of power tools and equipment.

SAVINGS WITH MODERN TOOLS

(Comparison for a Specific Industrial Building Contract)

Division of Contract	Hours 1938	1962 Estimated Savings		
		Percent	Hours	Principal Factor in Savings
Lighting—branch wiring, conduit and boxes	425	15	64	Scaffolding
Lighting—branch wiring—trim	96	5	5	
Lighting fixtures	160	20	32	Scaffolding
Feeders—conduit and pull boxes	150	20	30	Improved power pipe tools and scaffolding
Feeders—cable pulling	106	5	5	Improved pulling equipment
Panels and cabinets	80	..	..	
Connect to present switchboards	24	..	..	
Power branch wiring	128	5	6	Improved power pipe tools
100-Amp busway	172	20	34	Hoists and scaffolding
Miscellaneous	48	..	..	
	1,389		176	

Approximate Saving in Man-Hours—12.7%

Notes: Conditions—steel construction building; 14-ft ceiling height, clear floor area.

Source: Ray Ashley, Electrical Engineering and Estimating Consultant, Oak Park, Ill.

Experience

Field experience has proved that progressive application of power tools throughout an installation effects substantial over-all man-hour economies; extends the productive efficiency of older workers; preserves mechanics' physical reserve; redirects acquired skills and training to the more technical aspects of electrical construction.

The quantity and variety of job-tooling requirements will vary with the amount and type of work a contractor normally does. No specific list will find general application. Each must be developed to fit an individual contractor's needs.

Adequate job-tooling usually represents a substantial investment. This is not a overhead item. Tool charges should be allotted to each project as a direct job cost. These may vary from 3% to 6% of job payroll (based on field experience) depending on size and type of project. Tool charges are as much an installation cost as are the wages of mechanics on the job.

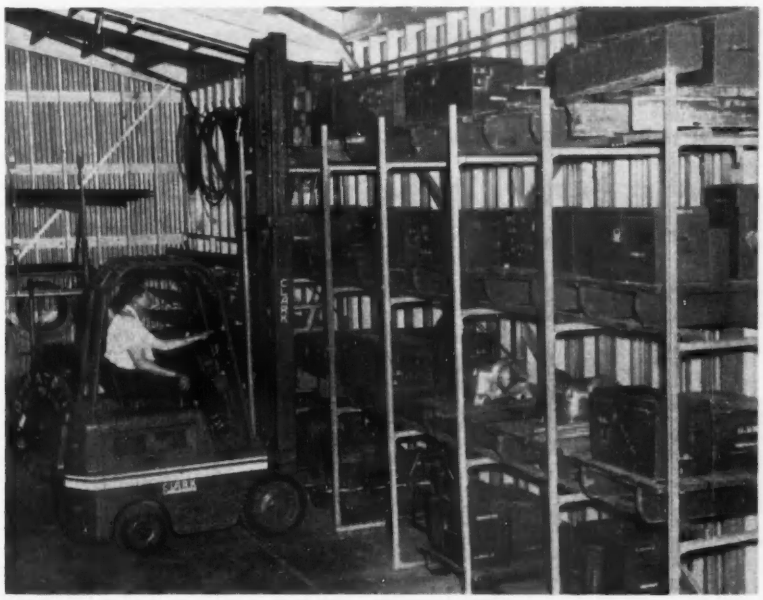
What tools and techniques can a contractor use to advantage? The following pages offer a fairly comprehensive report of mechanized field operations sectionalized into operational categories. Where available, relevant time-saving data are included. The tool check lists in each section are offered as a guide to establishing an adequate tool inventory or a handy reference for requisitioning purposes.

Interim tool purchases may be necessary to gain full advantage of power tooling on concurrent projects. Or specific tool items may be rented, with ultimate purchase in mind, for definite periods to offset abnormal peak demands. A number of such services are available to electrical contractors throughout the country. The best operating policy is, of course, to establish and maintain a permanent tool inventory to meet anticipated requirements. Development of a definite tool replacement program is considered good practice.

TOOL INVENTORY

Bins, materials and parts storage--metal, wood
Blocks, snatch
Block and tackle
Boxes, storage, stationary, rolling--wood, metal
Chains
Conveyor sections, roller, wheel
Cribs, parts and accessories stock--metal, wood
Cranes, chain, floor, overhead--manual, power driven
Dollies and carts, small, large
Hoists, chain, manual and power driven
Jacks, screw, reel, gang, payout--manual, hydraulic
Lift platforms--hand, motor, or hydraulic operated
Reel rollers
Rope, hemp, wire
Slings, rope--hemp or steel
Tongs, chain
Trailers, highway type for tool and material storage
Trucks, wagon, industrial, fork lift, highway type

MATERIAL HANDLING



TOOL BOXES and heavy power tools in contractor's warehouse are mounted on pallets so fork lift truck can quickly move them from rack to job truck. Tools coming in from jobs are checked and reconditioned before storage.

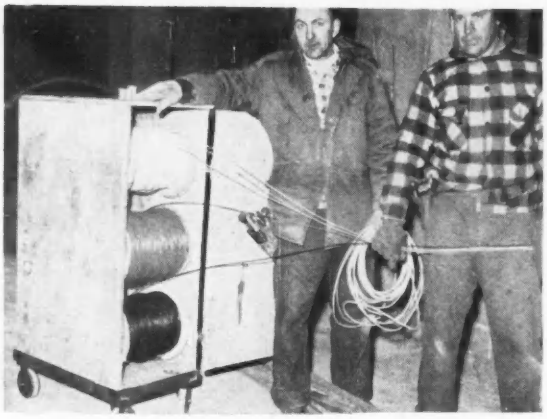
MATERIAL handling is one area of electrical construction where substantial reductions in job costs have been effected. It involves delivery of tools, materials and equipment to the job site, storage and redistribution to fabrication centers and movement to points of installation.

In the pre-mechanized past, this operation accounted for as much as 25% of the job man-hours. Over the years, adaptation of modern material handling equipment and methods to electrical construction requirements has reduced this to 5% or less on some current projects.

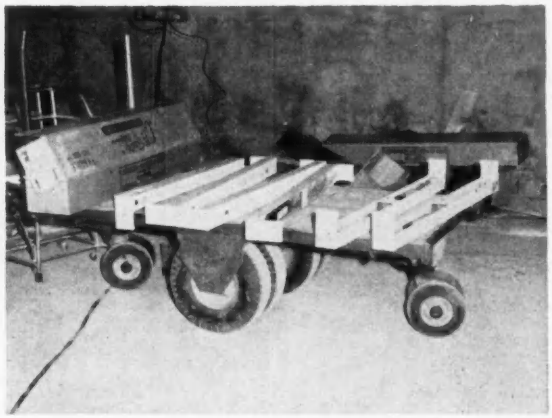
Material handling begins in the contractor's shop. Tools, conduit, fittings, cable, ladders, scaffolds, etc., must be loaded on trucks for transportation to the job. Some shops have hydraulic platforms to raise material to truck height. More contractors are equipping their trucks with hydraulic tail gates which operate as elevator

TRACTOR FORK LIFT unloads palleted bundles of fiber duct from flat-bed trailer; quickly spots them along open trenches for airport electrical system installation.

BOOM-EQUIPPED TRUCK lowers bundle of duct to concrete base of trench on an airport job. Spotting duct immediately ahead of installers slashes backtracking time to a minimum.



REEL CABINET on dolly base provides on-the-spot storage and pay-out facilities for six 2,500-ft reels of branch-circuit conductor.



RUBBER-TIRED DOLLY is specially designed for use on cellular steel floor construction. Four center tires distribute weight; are spaced so wheels will not wedge between cells.

HANDLING BUSWAY

PLUG-IN TYPE BUSWAY—HOURS PER FT

(3-Phase, 4-Wire)

AMP SIZE	WEIGHT/10-FT (LBS)	INSTALLATION TIME	
		MANUAL	FORK-LIFT TRUCK
225	85	0.330	0.330
400	130	0.375	0.375
600	150	0.390	0.390
800	220	0.675	0.450
1000	250	0.780	0.520

FEEDER-TYPE BUSWAY—HOURS PER FT

(3-Phase, 4-Wire)

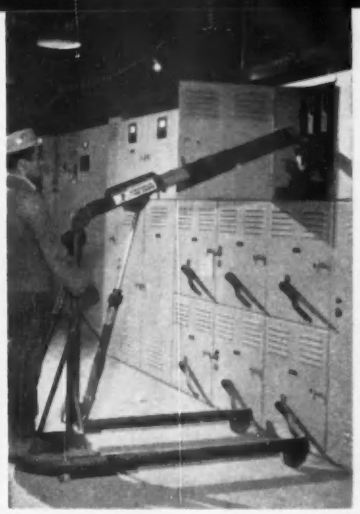
800	195	0.690	0.690
1000	235	0.825	0.825
1350	275	1.260	1.000
1600	325	1.440	1.100
2000	365	1.600	1.300
2500	445	2.400	1.600
3000	525	2.775	1.850

NOTES: Fastenings and hangers not included. Either 250 or 575 volts. Deduct 10% for 3-phase busway.
Source: Electrical Construction Cost Manual—McGraw-Hill Book Co., Inc.

platforms to raise and lower material. A number of the larger firms have one or more fork-lift trucks for shop and field use.

Highway semi-trailers, large and small, are a common sight on today's construction projects. Some are field offices and some are used only for storage of materials and tools. Others, particularly the larger ones, combine field office, warehouse and workshop in a single unit. Loaded and locked at the shop, they can be delivered to the job by common carrier, or contractor's own tractor. At the site, they replace the conventional "job shanty" (require no assembly and disassembly); prove less vulnerable to theft; are ready to roll again at a moment's notice. Field reports from users indicate they are exceptionally convenient, economical, and provide an effective advertising

HYDRAULIC BOOM raises men and materials to installation level in a matter of seconds. Detachable platform has remote control station. Removal of platform transforms boom into handy crane.



SMALL HYDRAULIC crane on U-shaped pipe dolly saves considerable material and equipment handling time on electrical construction projects. One man can easily move and operate the ½-ton unit.

SPECIAL DOLLY for transporting conduit and wiring accessories. U-saddle at base cradles conduit; parts box nestles on top. Unit normally is loaded at ground level and hoisted to building floor or deck.

medium. Many contractors own several units, rent additional trailers when work loads and storage problems warrant.

Once material and equipment has been delivered to the job, whether by the contractor or supplier, movement and dispersal to fabrication and installation points is the next step. Here, again, modern equipment and methods have drastically cut on-site material handling manhours. Among the time saving methods observed at a variety of electrical installations throughout the country were the following:

Switchboard sections and cubicles moved and set by fork-lift truck.

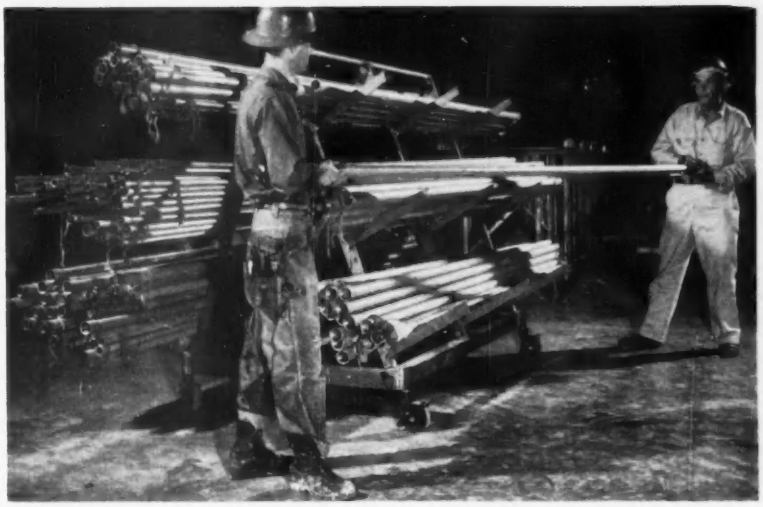
Large quantities of fluorescent fixtures stacked and delivered to job on wood pallets. Contractor's fork-lift truck unloaded pallets from semi-trailer and spotted fixtures at installation points. By prearrangement with manufacturer, fixtures were delivered without conventional cardboard cartons—eliminated factory packaging and job unpacking.

Palleted "stacks" of metal underfloor duct spotted by a crane at various floor levels of a multi-story building.

Motorized side platform attached to rolling scaffolds to raise busway and conduit into position for attachment to pre-installed hangers.

Mechanical and motorized "lift" attachments to mobile scaffolds and work tables to raise and hold assembled lighting fixtures in position for final circuit attachment.

More extensive use of a representative group of hand trucks and dollies to move materials from dis-

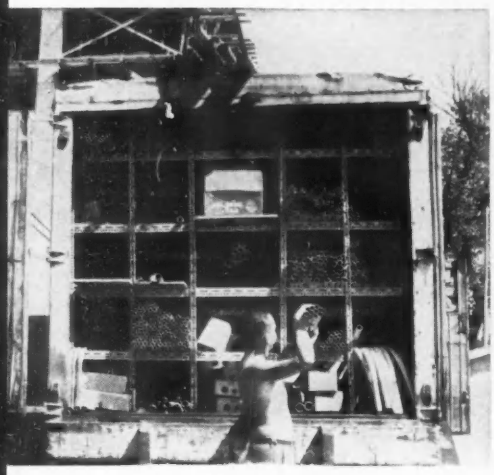


MOBILE RACK stores and transports hundreds of feet of different size conduit; has been used to supply fabrication centers and distribute pipe to installation points on large-area projects.

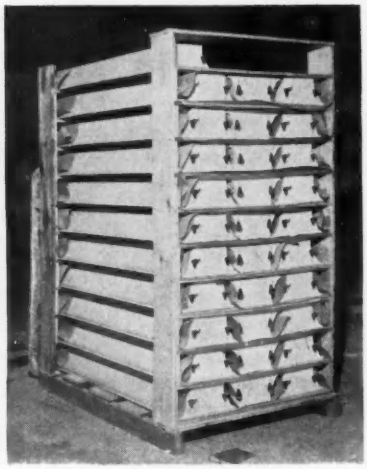
ICE-TONG HITCH was used to grip loaded lighting fixture crates in background. Construction crane hoisted crates to floors of high-rise building.

LOW-BOY TRAILER brings twin-arm lighting standards from rail siding to installation locations in business district. Specially designed unit has the capacity to carry three lighting standards.

METAL LOCKERS with bins for boxes and other wiring accessories keep electrical crews supplied on high-rise building construction. Sturdy casters on base provide mobility. Units can be hoisted for floor level by construction crane at site.



BACK SECTION of this trailer is devoted to material storage. Slotted-angle racks provide 25 "pigeon hole" troughs for conduit, boxes, fittings, etc. Front half of trailer is field workshop.



PALLETED STACKS of fixtures typify current delivery practice on large projects. These 33-fixture "packages" were spotted at assembly areas on various floors of new office building structure.

COLLAPSIBLE TOOL BOX provides free access to 34 cu ft storage space for tools and equipment. Hinged steel construction permits unit to fold into a 4-ft by 4-ft by 6-in. package.

tribution and pre-fabrication stations to installation areas. While distance, bulk and weight are controlling factors, this concept was also successfully applied to smaller items and smaller jobs.

A variety of mobile racks and containers for materials, fixtures, etc., that can be hoisted to various floor or deck levels, then moved about the area with comparative ease.

An increasingly broad use of mobile parts and accessory bins and cabinets for convenient storage and dispersal of the host of small items such as outlet boxes, conduit fittings, fastening devices and similar supplies. These have proved effective on both large area and multi-story construction projects. The ultimate goal is to reduce mechanics' backtracking to a minimum.

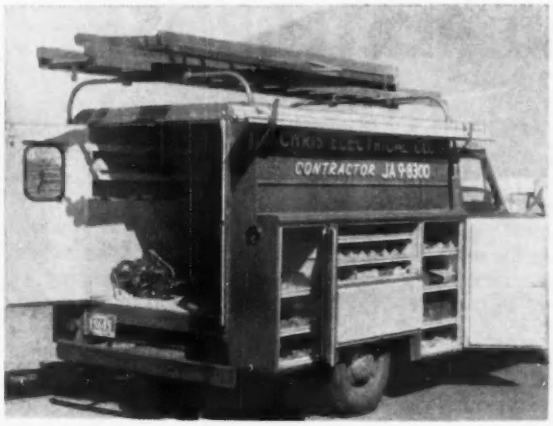
Where applicable, use of roller and wheel conveyor sections to position materials and equipment quickly and efficiently.

The type and quantity of time-saving material handling equipment on a given project will vary with the type, size and layout of the building and the structural conditions encountered therein. Much depends upon the ingenuity and field experience of contractor personnel constantly alert to mechanization opportunities.

Those who take full advantage of modern methods at this initial stage of a project invariably extend their labor-saving research to other installation categories. The net result is a progressive refinement of techniques and methods that benefit all concerned.

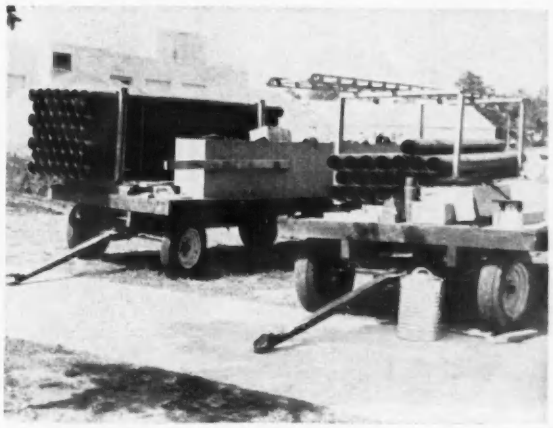
SERVICE TRUCKS with adjustable steel shelving and bin dividers are stocked with wiring accessories. Identical numbering of bins in some 40 trucks slash inventory control costs; cut service call time.

CONSTRUCTION CRANE unloads 70-ft steel poles from delivery trailer; later raised units, with assembled clusters of floodlights, in position for mounting to bases in airport parking lot.

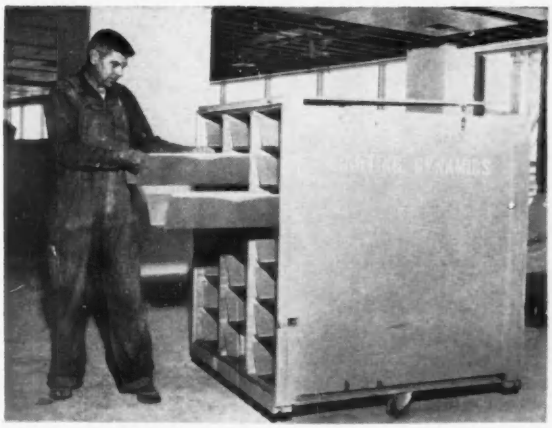


JOB PLANNED truck bodies are available to meet individual contractor requirements. This panel model provides interior shelving, plenty of space for bulky equipment, weathertight outside compartments for small parts and tool storage.

LARGE SEMI-TRAILERS combine field stock room, workshop and office in single unit offering maximum mobility from project to project. Sign on sides gives contractors definite advertising value.



FLAT-BED TRAILERS were used on university campus underground electrical system project to distribute sections of fiber duct as trenching progressed. Bins held couplings, spacers, etc. Duct sections were cut, beveled and fitted at back of trailer.



PLYWOOD CRATES totally enclosing 21 lighting troffers were trucked to job on trailers; hoisted to building floors with construction crane; moved around floor on dollies to various installation points. Empty crates went back to fixture manufacture.

TOOL INVENTORY

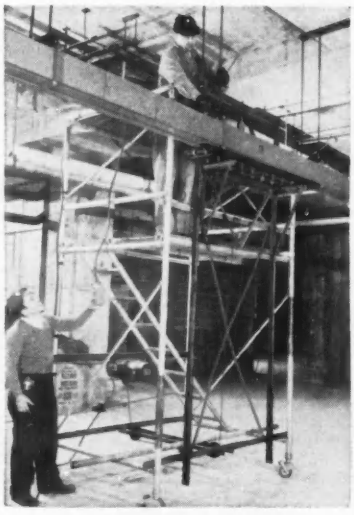
Beam buggies, overhead type, monorail suspension type--to work above or below roof steel before or after roof is in place
Elevating platforms, electric, hydraulic, hand operated--for one or more mechanics
Ladders, step, A, rigid, extension--wood, metal
Platforms, single, extension--painter's type, wood or metal, to bridge ladders or scaffolds
Scaffolds, adjustable, rigid, rolling, stationary, sectional, telescopic
Towers, rolling, hydraulic lift type with platform
Trucks, fork lift, platform boom, telescopic boom, telescopic ladder

SCAFFOLDING AND PLATFORMS

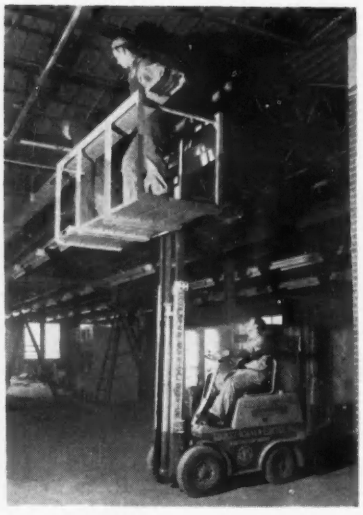
SOME type of scaffolding or elevating platform is needed on practically every electrical construction project. While the present trend is toward more ground-level assembly of system components, mechanics are still needed in elevated working positions to fasten these sections to pre-installed hangers or supports. Wherever possible, contractors strive to reduce mechanics' "high-time" to a minimum.

The type and size of work platform used depend upon the operation involved and structural conditions encountered. Equipment selected may range from the basic step ladder to the highly mechanized telescopic boom platforms rapidly gaining acceptance in the electrical field.

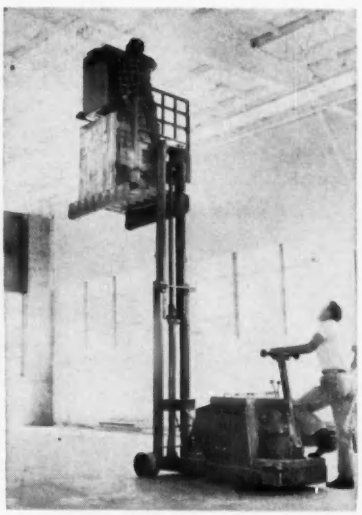
Personnel safety is a prime consideration and reliance on a makeshift scaffolding system is a hazardous, expensive and highly questionable practice. Unless mechanics working in high areas have confidence in their footing, manhours will climb, workmanship will suffer and anticipated savings from the use of power tooling may be nullified. That is why modern ladders and scaffolding are an important part of every electrical contractor's tool and equipment inventory.



MOTORIZED PLATFORM on side of rolling scaffold raises busway and conduit to overhead installation level. Remote control permits top-side or ground mechanic to control unit. Wheel conveyor platform inches material into coupling position.

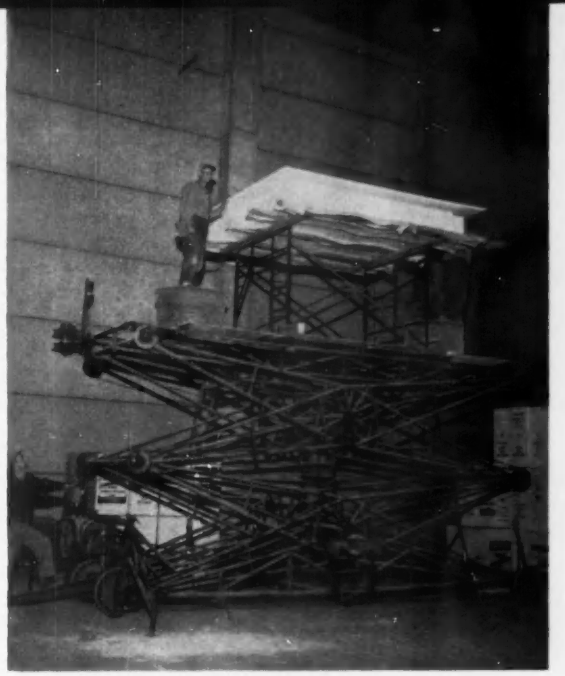


LIFT TRUCK with special platform on fork elevates men and material simultaneously. On one project, use of lift permitted 3-man crew to install busway with relative ease and in one-third the time formerly required by a 5-man crew.



MOUNTING TIME for transformers and unit heaters in an industrial project was cut drastically by use of fork lift. Contractors reported about one-half hour per unit or an estimated saving of 85% over the old block and tackle method.

TELESCOPING BOOM platform on flatbed truck raises fixtures and electricians to pole top installation level, can be moved quickly to next lighting standard for repeat operation. Platform is level at all boom positions.

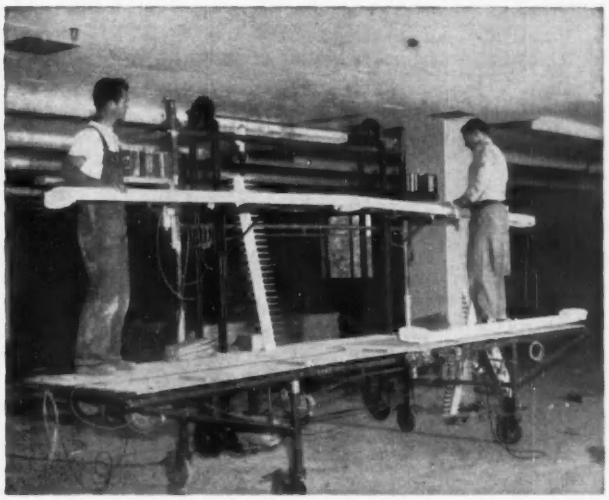


GIANT SCISSORS HOIST raises 650-lb, 10-ft square fluorescent fixture to 35-ft mounting height in less than two minutes. Mobile hoist has outriggers for stability and pushbutton control of elevating motor from platform or base.

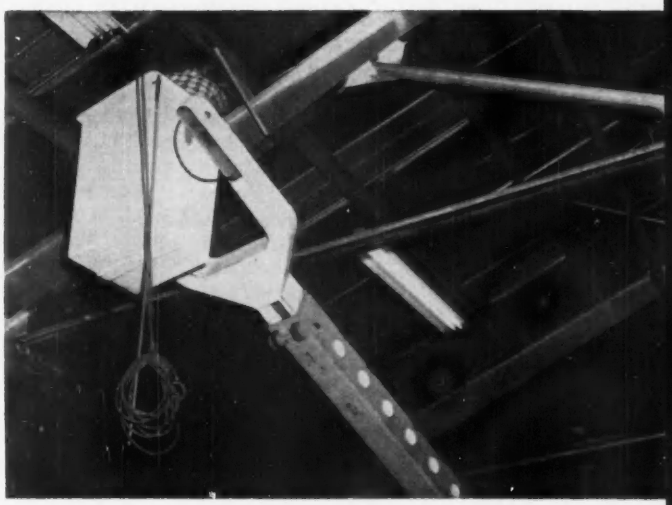
Most often seen on field projects are sectionalized scaffolding systems whose basic designs reflect careful consideration of electrical contractor needs. They are strong and lightweight for portability ease; they can be erected and dismantled in a mattter of minutes; additional sections can be added easily to attain prescribed height; they have locking swivel casters that facilitate job mobility, yet contribute to stationary rigidity. Some have "inside" stairways for climbing ease. All have helped the contractor effect substantial reductions in high-bay man-hour requirements; have, in effect, raised the ceiling on economical high-bay installation practice.

Field experience proves that adaptation of scaffolding systems to specific installation conditions and problems is limited only by the inherent ingenuity of the user. As noted in the preceding section, one contractor added a motorized lift to the side of a rolling scaffold to raise and position material for the installation mechanic on the platform.

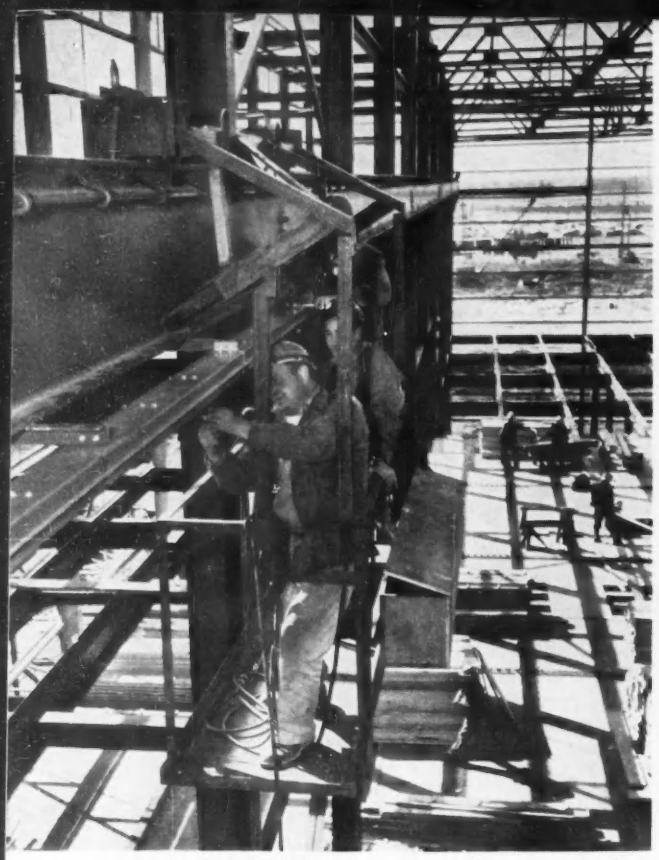
Another firm bridged two rolling scaffold towers with a sturdy work platform and incorporated an inclined motorized lift to feed busway and fixtures to the top-side mechan-



ROLLING SCAFFOLD with built-in motorized fixture lift permits two men to elevate and mount 16-ft sections of fluorescent fixtures to commercial building ceiling. Fixtures are assembled on front section of platform, then shifted to lift arms.



SAFE AND SECURE in crow's nest with remote boom control, this electrician works with confidence among building trusses. Boom is on highway truck; can be raised, lowered, extended, or rotated in almost any position for installation ease.



SIDE-SLUNG PLATFORM rides crane-rail beam; carries three electricians installing busway units in industrial high bay area. Platform has guard rails on all sides and attached tool and parts chest.

ADJUSTABLE SECTIONALIZED, lightweight, collapsible scaffolds provide level work platform on inclined surfaces. Rubber-tired wheels can be locked in stationary position for assured stability.

ics. Where required, effective work mezzanines can be built by bridging scaffold towers to provide wide-area work platforms for groups of mechanics.

Beam buggies have been used to advantage by some contractors on new flat-roof industrial projects. Alert field engineers designed a four-wheel rig (flanged wheels) to ride the top of parallel roof beams before roof installation. Electricians propelled themselves along in the rig, leaned down between guard rails and fastened suspension clamps and rods to the underside of the beams. On another project, monorail platforms, suspended from the underside of a beam, were successfully used to install electrical facilities without the need for high-bay scaffolding.

Scaffolding is most efficient where a substantial work platform is needed and where the floor area is level and clear. Even high-clearance units cannot be used effectively in some congested areas where installed machinery and limited traffic aisles are a problem. Under such conditions, telescoping platform units work well. They may be hand, electrically or hydraulically operated.

Fork-lift trucks with service platforms, platform boom trucks and variations of this type of equipment are finding extensive application to electrical installation and maintenance operations. While normally considered for material handling, these units have been used effectively to raise both material and men to overhead installation points.

For installation and maintenance work above the 30-ft level, a relatively new series of hydraulically operated, jack-knife boom platform trucks are being used by electrical contractors. Depending upon size, these units can extend to 40-, 60- and even 95-ft heights, swivel 360 degrees or more. Generally, the mechanic on the platform can fully control boom operation by a system of remote control switches. Although basically used for outdoor lighting maintenance, these units are being effectively adapted to indoor construction and maintenance projects in unusually high areas.

Standard estimating practice has been to add approximately 5% per foot for every foot above a 12-ft working height to labor units for specific installation categories. As indicated in the accompanying table, extensive use of scaffolding can reduce this somewhat. Chances are that field experience with the newer boom towers will show substantial savings on exceptionally high-level work.

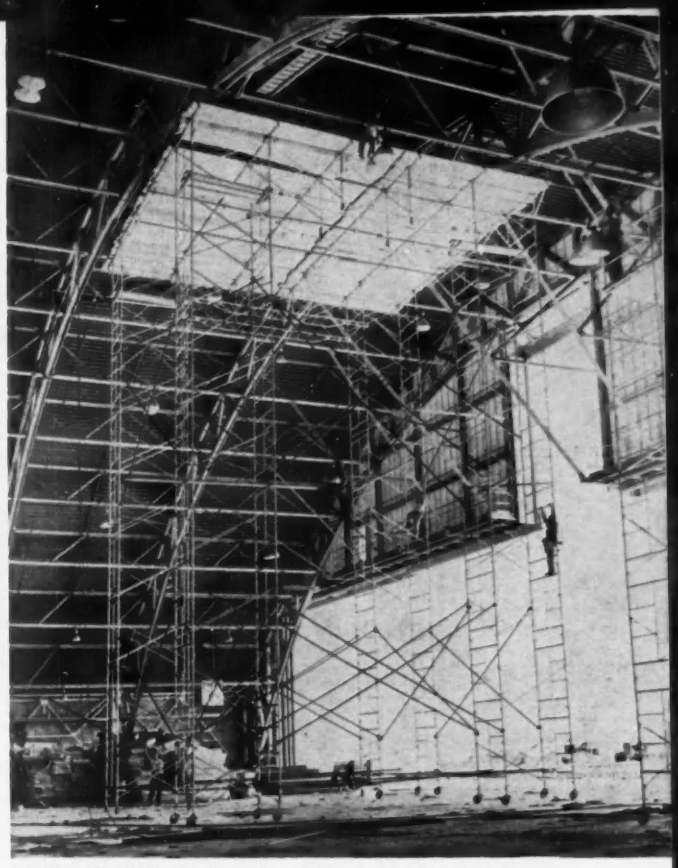
ADDITIONS TO MAN-HOURS FOR WORKING HEIGHTS

(Percent Added to Affected Man-Hours)

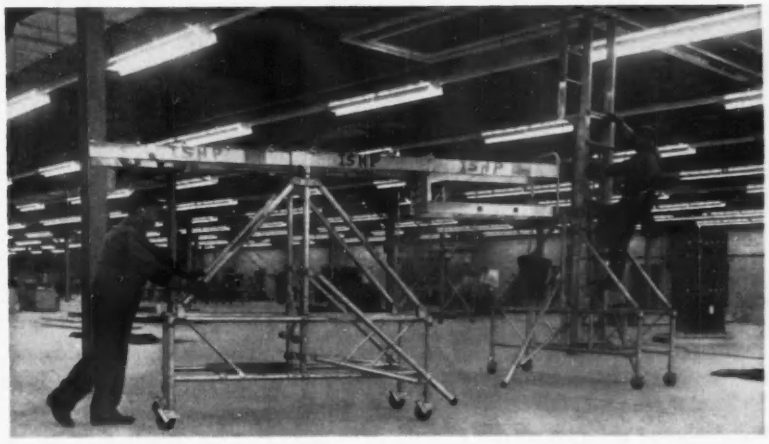
WORKING HEIGHT	USING LADDERS	USING SCAFFOLDS
14 ft to 18 ft	10% to 30%	10%
18 ft to 20 ft	30% to 45%	10% to 30%
20 ft to 28 ft	85%	30%
28 ft to 30 ft	.....	30% to 45%
30 ft to 36 ft	.....	45%

Source: Electrical Construction Cost Manual—McGraw-Hill Book Co., Inc.

INSIDE STAIRS for climbing ease is a feature of this collapsible, lightweight aluminum rolling scaffold. Here, two sections are used to work on lighting system. Other sections can be added quickly to extend working height.



SIXTY-FT HIGH mobile work platform gives electricians sure footing in aircraft hanger installation. Platform rests on steel framework supported by built-up sections of rolling scaffolding.



MOBILE ALUMINUM ladders retract for passage through doorways; have safety work platform; lock in vertical position and extend to 30 ft. Outriggers stabilize base. Using these units, a contractor reported a 25% labor saving on a 3600-fixture lighting installation.

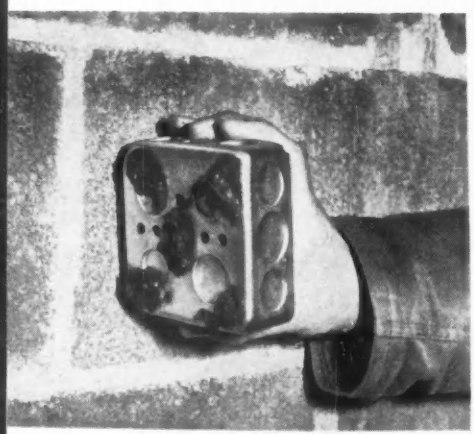
LIGHTWEIGHT STEP LADDERS elevate electricians to convenient working height. Units, dimensioned for ceiling height, have rubber-tipped legs for rigid stationary positioning and lever-operated caster assembly for rolling to work areas.

FIXTURE LIFT on rolling scaffold permits one man to install 4-ft unit in ceiling recess. Spring-operated lift is first raised to lower level so mechanic can make flexible circuit connection to fixture.

TOOL INVENTORY

Anchor sets--masonry, etc.
Braces, ratchet
Burners, acetylene, gas
Clamps, C, beam, pipe, tap-on
Cords, electric extension
Crimping tools, manual, hydraulic
Drills, wood, masonry, steel, twist, star, core, tall reach, Carboloy tipped, diamond core.
Drills, manual--separate, integral part of anchoring device
Drills, electric--high speed, slow speed, impact type
Drivers, stud--powder actuated
Drivers, concrete nail
Electric welders, stud, spot
Epoxy adhesive--for mounting junction boxes
Framing, continuous channel, slotted angle
Goggles, safety
Gloves, safety
Hammers, manual, electric, pneumatic
Inserts, concrete
Nut runners, electric, pneumatic
Screw drivers, hand, ratchet, drill attachment
Screws and bolts, assortment
Stocks, bolt, angle, channel
Taps and tap wrenches
Torches
Welding equipment, electric acetylene

FASTENINGS AND SUPPORTS

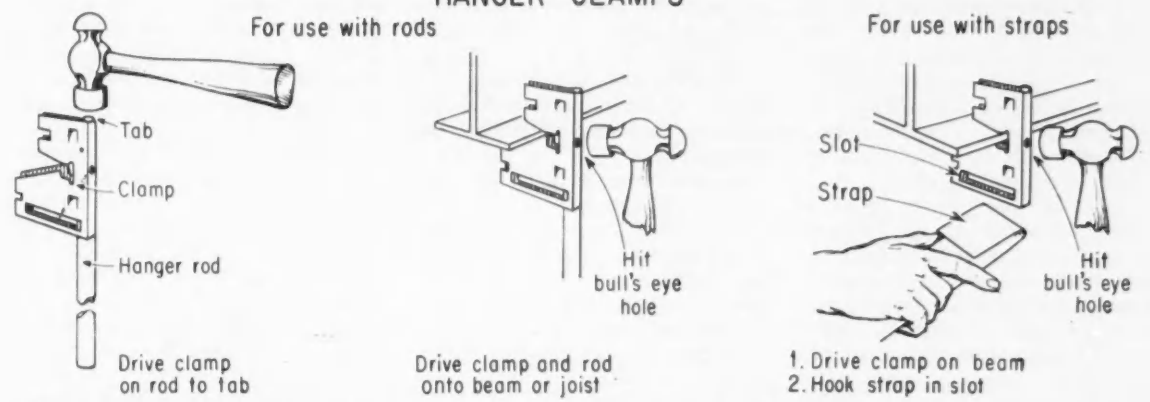


EPOXY ADHESIVE on back of metal outlet box bonds box to walls without anchors or studs. Works well when quantities of boxes are to be preset before conduit system is installed.

TECHNIQUES for fastening and supporting electrical materials and equipment to building structures offer a wide field for application of conventional power tooling. While considerable progress has been made in this area in the past, electrical contractors are still searching for new ways to do the job better and in less time. The entire industry shares this interest. Evidence of this abounds in the variety of new and improved hand and power tools and accessories currently available to the construction trade; also the constant supply of new and improved fastening devices being offered by manufacturers. Combine this with increased trade acceptance of time-saving ideas and you have a basic formula for reducing installation costs.

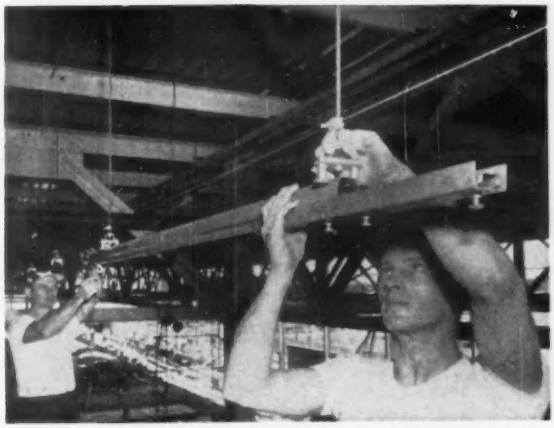
This work category can logically be divided into two distinct classifications: (1) tools—the hand-held and power units which can be used anywhere on the job; and (2) devices—the variety of anchors, bolts, studs, clamps, etc., that comprise the fastening and supporting means.

Perhaps the most common and universal tool item is the electrical drill—an accepted "must" on every contractor's tool list. On most electrical construction projects there are from one to a dozen or more electric drills of different sizes, capacities and speeds depending upon the work involved and number of mechanics on the job. In fact, the electrical drill is rapidly becoming as important to an electrician's effectiveness as is his own personal



DRIVE-ON CLAMPS made of heat-treated, high-carbon steel minimize the time required to fasten supports to steel structural members. A hammer is only tool needed.

HAND SET is used with concrete nails or drive pins to speed anchoring of underfloor-duct saddles to concrete base. Saddles in this system are also duct couplers.



ROLL-IN HANGERS on rod supports speed installation of a specific type of trolley busway. U-bolted messenger cable line maintains spacing between hangers and eliminates axial sway.

tool kit. Some contractors have saved considerable time by supplying complete sets of twist drills, charged out on requisition, for each drill sent out; others have furnished, where installation conditions warrant, dolly carts for the drill kit and mechanic's tool chest.

New and improved attachments extend the usefulness of the conventional electric drill. Right-angle heads with speed-changing features permit drilling in limited spaces. A variety of extension attachments permit drilling overhead areas while standing at ground level. And some drill assemblies have magnetic bases to securely anchor the drill to steel when boring holes for equipment supports. Metal cutting hole saws, circular saw and reciprocating saw blade attachments reduce to a single operation many cutting tasks which formerly required multiple-drilling and hand sawing. Handy bench stands transform the unit into a drill press for fabrication work. By using carbide-tipped masonry drills, core units and diamond-tipped core drills, electric drills can efficiently cut large openings in masonry construction (covered in a later section).

A variety of cutting, drilling and installation operations can be performed by the electric hammer, electric impact tool, electric nut-runner and screwdriver. Hammers are available in two designs: the solenoid type with its natural reciprocating motion; the electric motor type with a mechanism to convert rotary motion to sharp impact blows. Impact and nut-running tools have high torque characteristics and clutch release devices which permit tapping, nut-running, screw driving and similar operations.

Selection of proper type, size and capacity of an electric power tool is vitally important to efficient operation. If a tool is too small or "light" it may not do the prescribed job and may burn out.

Adequate maintenance and repair is another item to be considered. Many contractors have special tool repair departments to maintain their power tools in top operating condition.

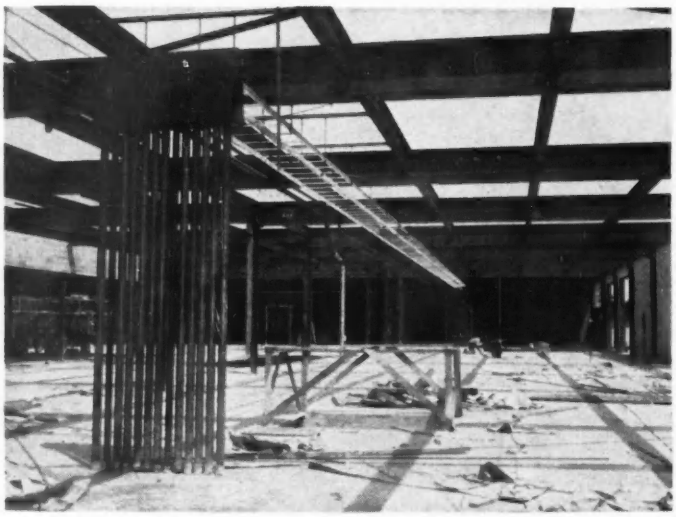
Undersized extension cords are an important factor too frequently overlooked by contractors. Voltage drop will lower the efficiency of a power tool just as effectively as a

dull twist drill or cutting edge. Use the table shown below as a handy guide to selection of proper size conductors for long extension cords.

For safety reasons, all portable electric tools should always be grounded either by means of a three-conductor cord and plug, or separate grounding conductor.

Use of an oxyacetylene torch is still considered one of the quickest methods of cutting steel, particularly heavy stock. Permission to use this should first be secured from the supervising architect or engineer. To preserve design strength, many structural engineers limit or definitely prohibit cutting, drilling or punching steel even for bolts or rod supports. Because of this, electrical contractors originally shifted to electric stud or spot welding, powder-actuated stud drivers, or a variety of clamp-type devices for fastening and supporting electrical equipment.

Electric welding has been used quite extensively for field and shop metal-to-metal bonding. Among many diverse applications: fastening supporting brackets and similar devices to structural steel; "tacking" outlet boxes and conduit supports to metal uprights for "deck" work; fabricating a variety of metal brackets for supports.



LADDER RACKS of lightweight metal to support armored and insulated cable circuits were installed before building roof was added. Circuits go underground at pull box to electrical distribution room.

SIZE OF EXTENSION CABLE FOR PORTABLE ELECTRIC TOOLS

Based on current equivalent to 150% of full load of tool and a voltage drop of not over 5 volts. This table is for 110-volt tools. For 220-volt tools use wire size corresponding to an extension length of one-half the contemplated length.

Full load ampere rating of tool	Wire Size (B & S Gage)					
Distance—Ft (one way)	0–2.0	2.1–3.4	3.5–5.0	5.1–7.0	7.1–12.0	12.1–16.0
25	18	18	18	18	16	14
50	18	18	18	16	14	12
75	18	18	16	14	12	10
100	18	16	14	12	10	8
200	16	14	12	10	8	6
300	14	12	10	8	6	4
400	12	10	8	6	4	4
500	12	10	8	6	4	2
600	10	8	6	4	2	2
800	10	8	6	4	2	1
1000	8	6	4	2	1	0

NOTE: If voltage is already low at source (outlet), have voltage increased to standard, or use a much larger cable than listed in order to prevent any further loss in voltage.

Probably the most versatile and efficient fastening tool in current use is the powder-actuated stud driver. Light in weight and easy to handle in almost any position, it can be used to drive mounting studs in steel and a number of types of masonry construction. Selected cartridges provide powder loads for light, medium or heavy-duty fastening. A variety of stud types and sizes permit direct anchoring of materials, or driving of threaded (external and internal) studs for subsequent anchoring of supporting rods and brackets. Special guards are available for use with a number of electrical equipment items. Progressive design improvements and extensive field experience have eliminated much of the initial skepticism about the safety of this split-second fastening tool.

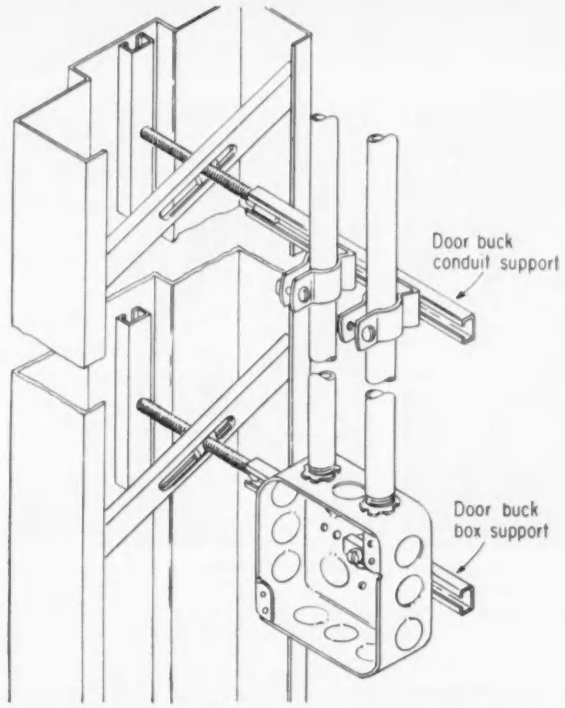
Devices

There always has been a variety of clamp-on devices for fastening equipment to steel members. Although normally listed as material items, such devices logically can be considered labor-saving "tools" when a broad definition of the term is applied. Recent addition to this rather extensive line of fastening devices is a family of "tap-on" or "drive-on" clamps made of heat-treated, high carbon steel. Only a hammer is needed to fasten a rod, channel, bar or cable clamp to steel I-beams or bar joists or to drive an unthreaded suspension rod into the patented clamp.

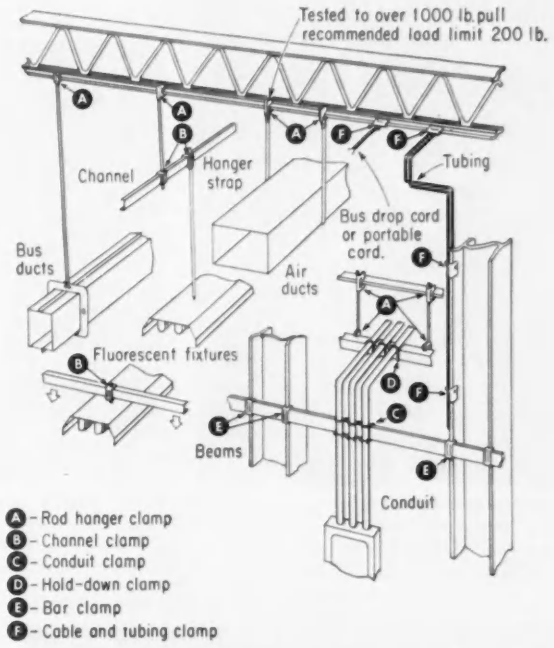
Another perplexing fastening problem—that of supporting outlet boxes and conduits from steel door bucks used in modern building construction—has been solved by the recent introduction of an easy-to-install clamp designed specifically for that use.

Most recent addition to this category is the development of a two-part (resin and harder) epoxy adhesive for attaching junction boxes to masonry walls, tile, ceilings and floors as well as to metal beams, wood panels, etc. Engineered specifically for the electrical construction field, this material reportedly permits an electrician to preset eight to ten outlet boxes in less than 15 minutes. The adhesive holds a box after five seconds of applied pressure, completely hardens in three to four hours at 70°F (quicker with applied heat).

A number of other anchoring de-



JACK SCREW clamps simplify supporting of conduit and outlet boxes to steel door bucks used in modern construction.



CLAMPING DEVICES are available in a variety of types to simplify installation of electrical equipment and materials.

OVERHEAD DRILLING time is drastically reduced when recently developed 4-ft drill extension is used. Mechanic works at floor level. Self-feeding wood bit minimizes drilling pressure.

RIGHT-ANGLE drills and drill attachments simplify hole cutting in close quarters on both wood and steel structures. Net result: more accuracy; less time.

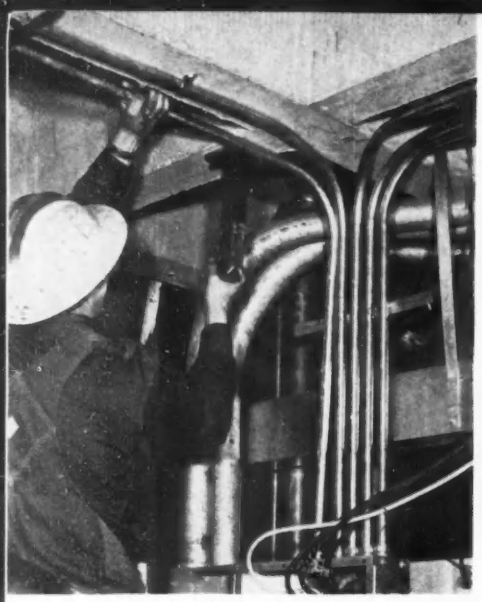
SELF-DRILLING metal anchor on impact hammer cuts own hole in masonry and is withdrawn. Tapered metal plug inserted in base expands the anchor when it is driven into hole.

vices are also available for use in concrete, masonry, tile and a variety of wall constructions. Some are the self-drilling type; others require a pre-drilled hole. Whether hand or power tools are used depend upon the number of anchors involved, size of project and the economic considerations on each job. Each has its place and it is up to the contractor to make his selection accordingly.

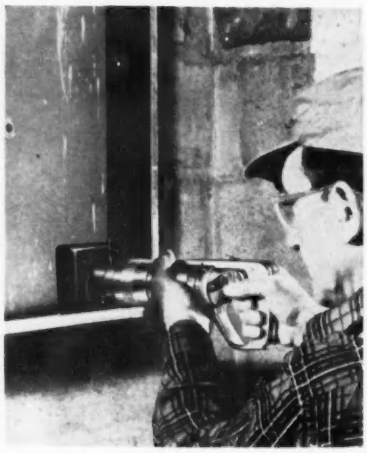
Such items, seemingly insignificant at first glance, can effect a substantial man-hour economy on the installation phase of an electrical construction project.

Also falling in the time-saving fastening classification are such material items as concrete inserts, continuous channel framing, slotted angle framing, conventional angle and channel iron. They often are used in the structural sense to provide rigid supports for raceways, fixtures, etc., where long spans must be bridged and the number of suspension rods kept to a minimum; or as a rigid free-standing or structurally supported frame for control devices.

Continuous channel framing with its sliding nut and bolt attachment feature, offers substantial equipment installation economy since no premeasuring, punching or drilling

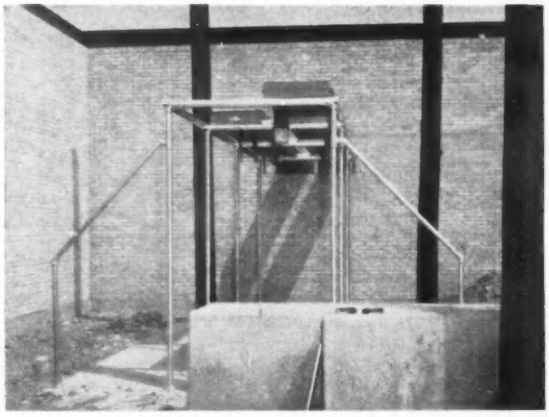


STUD GUNS solve fastening problems in tight places. Here mechanic "shoots" threaded stud into concrete beam for conduit strap.



FOUR SHOTS with a powder-actuated stud driver and this distribution cabinet is fastened to a concrete block wall in a matter of seconds.

PLYWOOD TEMPLATE with two cut-outs at each end to seat stud-gun guard quickly and accurately positions threaded studs for fastening fluorescent fixtures.



STURDY PIPE RACK on transformer mat supports twin sections of raintight busway connecting outdoor transformers to indoor switchgear.

MACHINE SCREW AND MACHINE BOLT FASTENINGS—HOURS, EACH

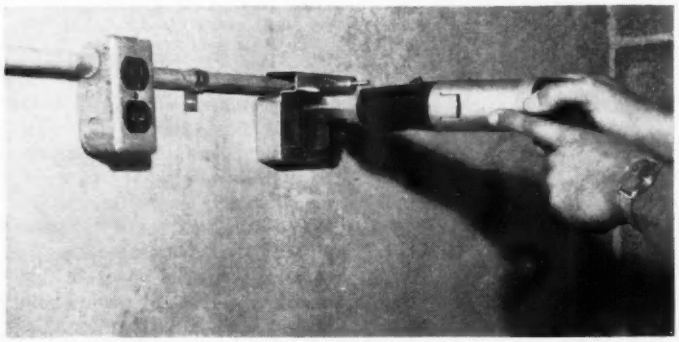
	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
Machine Screws in Steel, Drill and Tap	0.30	0.33	0.35	0.40	0.43	0.47
Machine Bolts in Steel, Drill	0.18	0.22	0.25	0.28	0.31	0.35
Powder Actuated Tool, Studs, Pins	0.04	0.04	0.04	0.04	0.04	0.04

Source: Electrical Construction Cost Manual—McGraw-Hill Book Co., Inc.

is required. The same is true of slotted-angle framing with its array of prepunched holes and slots to accommodate mounting bolts. Choice of method is a function of the economics of the job at hand. This type of framing is used extensively for multiple raceway support of the bracket or trapeze hanger design. It minimizes the number of structural anchoring points and, when of sufficient length, simplifies the installation of additional parallel circuits in the future.

Messenger cable systems still find ready application for supporting conduit, fixture and duct lines where structural conditions physically or economically limit the number of vertical hangers. Generally, this is for a single line of equipment and lacks the expansion flexibility of the continuous framing technique.

Contractors attribute a progressive reduction of installation manhours to: increased application of more power tools; development of new and improvement of existing techniques; selection of materials which feature installation ease.



CONDUIT CLAMP GUARD on power-actuated tool positions clamp and pin and fastens both in split-second operation.

TOOL INVENTORY

Benches, large, small, wood, metal--stationary, rolling
Benders, pipe, tubing, hydraulic, mechanical, manual or power driven
Block, snatch
Block and tackle
Burners, gas, acetylene
Chains
Chalk, chalk lines, crayons, marking materials
Crimping tools--manual, hydraulic
Dollies
Drills, electric hand
Drills, electric impact
Drill presses
Drivers, stud, powder actuated
Forge
Hacksaw, hand, power driven
Hickeys
Hammers, ball peen, claw, plastic and rawhide faces
Hammers, electric, pneumatic
Hoist, chain, manual, power driven
Jacks, screw, hydraulic--manual and power driven
Jigs and frames for assembling groups of fixtures and other equipment
Levels, carpenters, surveyors
Lift platforms, scaffold, boom, tower--manual or power operated
Nut runners
Power drive, universal
Power drive adapter for use with ½-inch electric drill
Pinch bars
Plumb bobs
Punches, knockout, mechanical, hydraulic--all sizes with dies
Punches, Whitney for steel
Saws, hack, band, knockout, skill, keyhole, masonry, carborundum, wheel--manual, power driven
Scaffolds, rigid, rolling, stationary, sectional, telescopic
Screw drivers, hand, ratchet--manual, power driven
Shears, sheet metal, angle-iron--manual, power driven
Sledges and hammers
Stock, bolt, angle, channel, continuous channel framing
Seals, conduit
Splicing tools, soldering equipment
Taps and tap wrenches
Threaders, conduit, pipe--hand, power
Torches, soldering, gas
Tongs, chain
Vises, pipe, machinist, power
Welders, stud, spot
Welding equipment
Winches, manual, power operated
Wrenches, pipe, socket, adjustable, Stillson S

ASSEMBLY TECHNIQUES

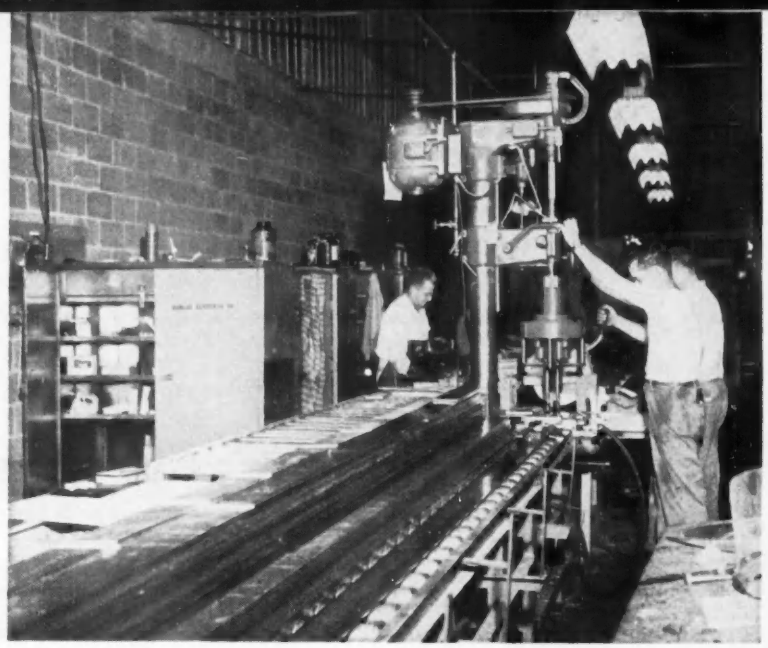
FIELD assembly and prefabrication of electrical system components have become an established practice in the electrical construction industry. Cost-conscious contractors have substantially increased the effectiveness of power tools by carefully planned centralized concentrations of related tools and fabrication operations. With this assembly-line approach, field supervisors on some of the larger projects have been able to shave normal labor units 20% or more.

This concept is particularly adaptable to projects with numerous typical floors or repetitive area layouts requiring duplicate conduit runs and component assemblies. The current trend is to do as much work as possible at ground level, or at one location, and distribute assembled units or sections to installation points (floors, decks, areas, etc.). By doing this, job supervisors find they can use available manpower more effectively and much more efficiently.

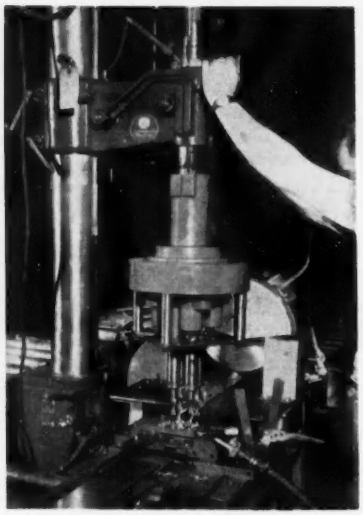
The number and location of work areas set up on a specific project depend on building construction (multi-story or sprawling single-story), type of electrical work involved, size of electrical crew and quantity of tools available. Tooling a project for highest installation efficiency is definitely a contractor responsibility. It is to his advantage to supply enough tools, materials and equipment to keep his men busy at all times.

One contractor solved an exceptionally large area tooling problem by placing his mechanized fabrication center on a low, rolling platform which subsequently was moved from area to area as installation progressed. Others rely on a stationary center (or centers) strategically spotted to economize on material distribution time.

Most adaptable to centralized production methods are these conventional operations: fabrication and assembly of brackets, racks, frames, suspension hangers and other material and equipment supporting facilities; mass bending of conduit and tubing for parallel raceway installation; cutting, drilling, threading and plating (bus bar) operations; and a variety of assembly procedures.



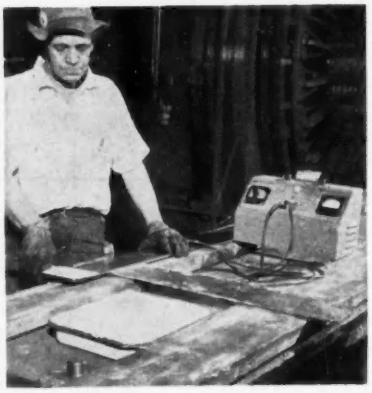
CONVEYORIZED ASSEMBLY line set up by contractor to field fabricate busbars for large electroplating installation. Bars roll from shipping crates through work stations to final assembly table.



DUAL IN-LINE work station has four-spindle drill press and circular saw to drill and cut busbars as they pass along conveyor in contractor's field fabrication shop. Air hose blows away chips.

TEMPLATE PUNCH marks hole locations in end of busbar. Some contractors prefer to punch copper bus rather than drill holes for bolted connections.

BELT SANDERS clean busbar contact areas in a jiffy. Polished surfaces are then silver plated to assure good bolted contact.



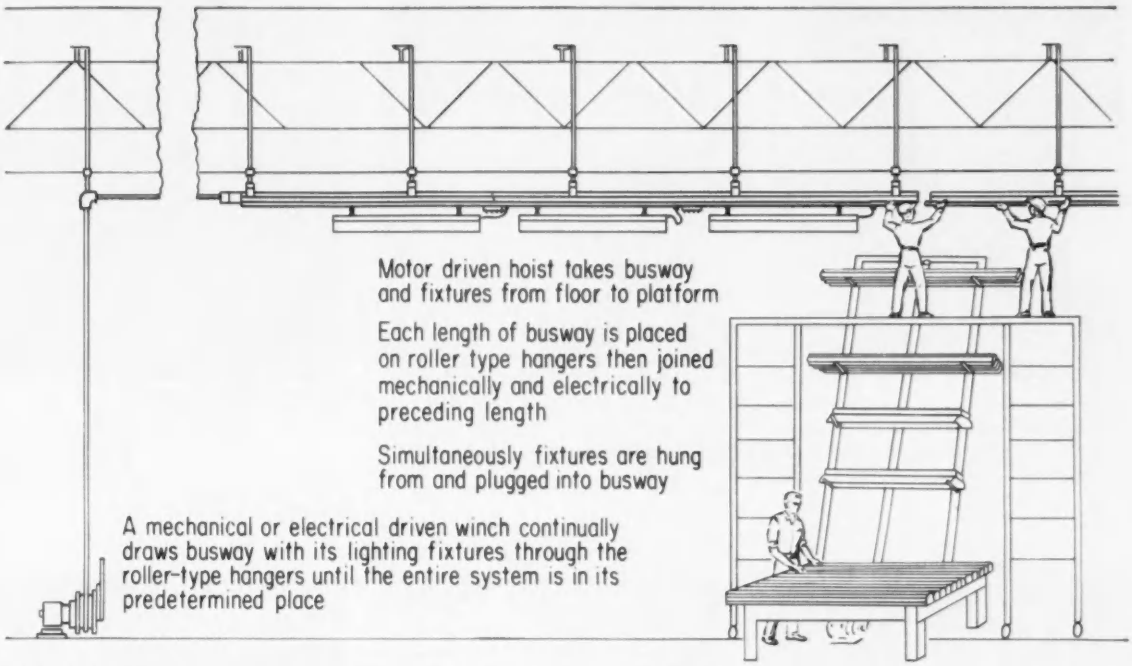
BRUSH ELECTRO-PLATING unit is used in the field to silver plate contact areas of copper busbar. Brush pad saturated with silver nitrate solution leaves silver deposit on copper.

Tool and equipment selection must be tailored to job requirements. An average field shop equipment inventory might include one or more of the following: power benders (for large pipe); hand benders (for smaller conduit); power threaders; power vises; metal cutting band and circular saws; grinding wheels; drill presses, assembly jigs and frames; metal punches; spot welders; assembly benches; and the normal complement of hand tools. These are primarily fabrication and assembly items. Other tools (discussed in other sections) and equipment for material handling, cable installation, etc., should also be on the job site to maintain high overall efficiency.

Busbar fabrication and assembly (for exposed-bus installations) can often be performed on a continuous production-line basis. On a large industrial installation, an enterprising contractor set up a conveyorized field-assembly procedure with the following in-line work stations: circular-saw cutting table; multiple-spindle drill press; belt sanding table; silver-plating section; power bender station and assembly table. Busbar, stored on a roller-table at one end, went down the roller-conveyor line, through the various fabrication operations, and emerged ready for assembly and installation at the other end. This same concept was adapted to similar installations on several other projects.

Another contractor modified a conventional hydraulic conduit bender so his mechanics could edge-bend copper busbar for a plating installation. The net result was fewer bolted joints; a considerable reduction of cutting, drilling and bolting time; and a much better over-all installation.

Roll-in busway units, a quick assembly and installation procedure originally conceived by an electrical contractor, is an outstanding example of cooperative electrical industry endeavor to cut industrial


Motor driven hoist takes busway and fixtures from floor to platform
Each length of busway is placed on roller type hangers then joined mechanically and electrically to preceding length
Simultaneously fixtures are hung from and plugged into busway
A mechanical or electrical driven winch continually draws busway with its lighting fixtures through the roller-type hangers until the entire system is in its predetermined place

ROLL-IN SYSTEM for industrial busway units and fluorescent lighting cuts normal installation time in half. Busway and fixtures are elevated, assembled and connected at one work station per line; are winch-pulled or pushed into preinstalled roller hangers.

plant lighting system installation costs. Now available in one or more types, this time-saving material "tool" presents a unique approach to relighting plants without interrupting normal production. Biggest advantage is that busway can be assembled, connected and (with fixtures attached) pushed or pulled in preinstalled roller-hangers. All this can be done from a central station with minimum interruption to production workers below.

Not all preassembly and prefabrication operations are done in the field. Some contractors keep mechanized equipment setups in their own shop to fabricate and assemble on direct order from the field. This is particularly helpful when job conditions prevent setting up efficient field operations. These tool items never leave the shop; they are retained to supplement the complement of tools and equipment normally sent to the job site.

Field grouping of tools in a well-arranged work center is being used extensively whenever practicable. But this is not always the answer to the ultimate in job efficiency. In specific cases, use of power tools at point of installation may be more feasible.

On a project street lighting installation, one enterprising contractor saved considerable time by using power coupling of conduit. A conventional pick-up truck bearing a portable-generator-operated power drive followed the streets where 1-in. conduit had been prespotted. With one length of conduit turning in the drive jaws, mechanics progressively coupled up to 300 ft which was then "kicked" into the shallow trench behind curb line. Under normal conditions a two-man team installed 6,000 ft per day.

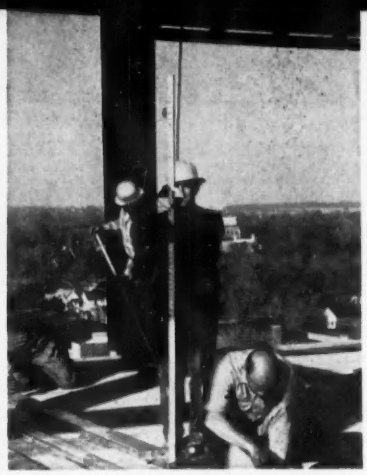
Surveyor's transits and rods are being used extensively to level underfloor duct systems. Normally, one instrument has an effective working radius of about 400 ft compared to approximately 50 ft with

POWER BENDER at end of bus field-fabrication line shapes copper busbars to specified configurations for preassembly into installation sections.

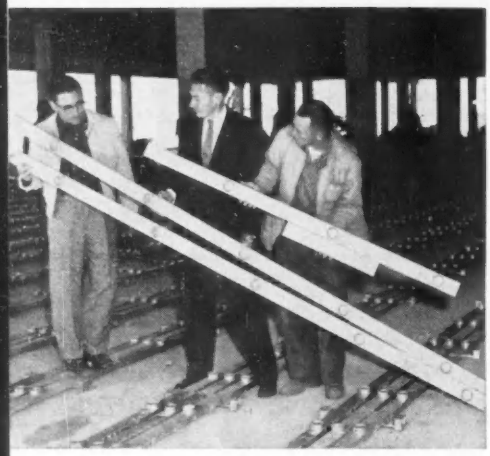
EDGE BENDING of copper bus bars with modified conventional hydraulic conduit bender eliminated numerous bolted connections in extensive electro-plating installation; reduced cutting and drilling (or punching) time.

HOLE SAW on heavy-duty drill extension mandrel cuts openings in steel cell floor to match handholes in electrical header duct.

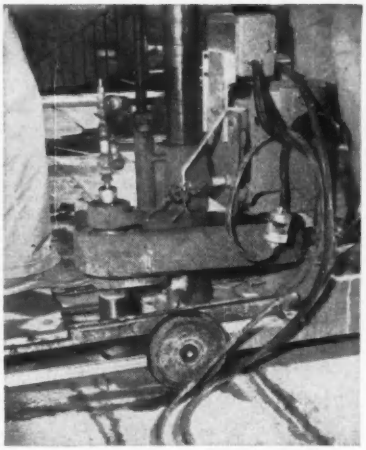
HYDRAULIC GROMMETING tool, designed by electrical contractor, flanges header duct steel grommets in a matter of seconds. Grommets fasten duct to steel cellular floor; eliminated need for duct straps.



SURVEYOR'S TRANSIT AND ROD are time-saving electrical contractor "tools." Units facilitate leveling of underfloor and header ducts; have effective radius about eight times that of old string and wire method.

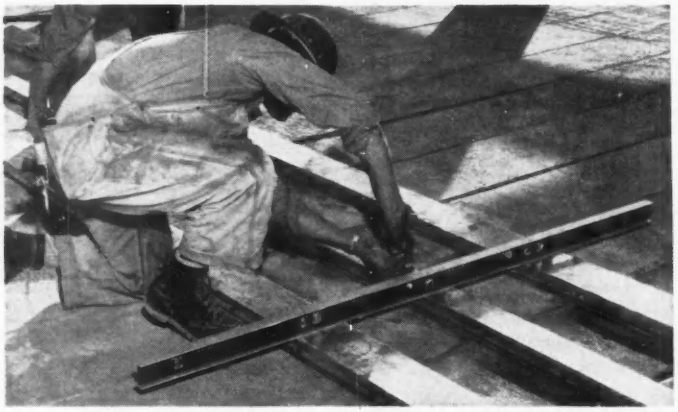


FACTORY PRECUT lengths of underfloor duct, ordered by electrical contractor, slashed installation time; eliminated field cutting and material waste. Based on carefully dimensioned layout, triple-duct system went together like a jig-saw puzzle.



DRILL RIG with diamond-tipped core drill straddles transverse header duct section; takes only minutes to cut holes in cellular concrete floor slabs to match duct openings.

POWERFUL VACUUM from tank-type industrial vacuum cleaner lifts drilled plugs from cellular concrete floor cells; sucks water and debris from header duct access areas within cells.



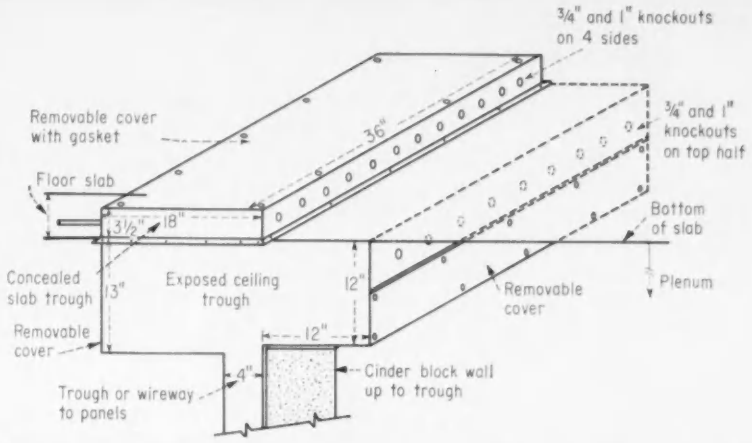
EXTRA LONG LEVEL bridges triple run of header duct; speeds leveling of duct sections to prescribed height. Transverse headers serve electrical cells in cellular concrete floor construction.

the string or wire method. Transit teams of three mechanics have been known to level up to 2,400 ft of duct in about six hours.

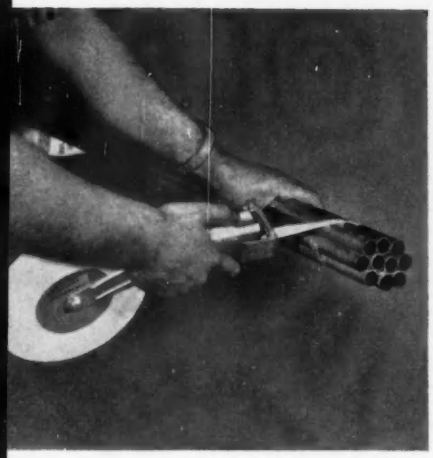
Because of the variety of power cutting and punching tools now available, many contractors are ordering panel boxes or "tubs" without conventional stamped knockouts. They find it less costly to cut (holesaw) or punch (hydraulic punch) openings in the field, than to try to align conduit stubups and connecting nipples to match factory stamped knockouts.

These are but a few of the numerous field examples of mechanized methods currently being used by electrical contractors. The record

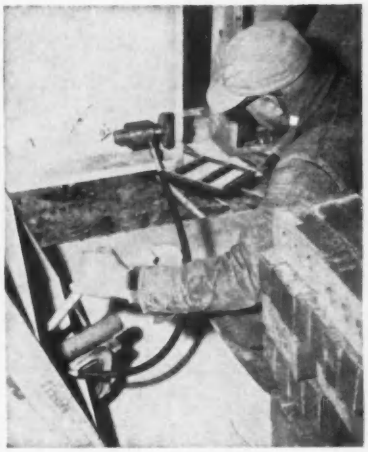
PREBENT AND CUT lengths of EMT are bundled according to bay or area requirements and delivered from fabrication center to deck crew for installation before concrete pour.



SLAB WIRING TROUGH eliminates home run conduit bends to distribution panel. Slab conduits run straight into sides of concealed section. Exposed section under slab provides large pull box with trough or wireway extension down to panel.



ADHESIVE STRAPPING TAPE with handy dispenser speeds bundling of preselected or prefabricated conduit lengths for delivery to installation site. High strength woven glass reinforced tape is available for heavy-duty packing and strapping.



HYDRAULIC KNOCKOUT PUNCH quickly punches openings in sides of panel "tubs" for connecting nipple. Unit is small, accurate and saves considerable time when working in close quarters such as shown in the photo.

PREASSEMBLY of beam clamps and suspension rods to continuous channel sections to be used as equipment supports. Ground assembly like this limits "overhead" work to a simple clamping operation.

shows many more and the list grows bigger with each new project and each new idea that comes up. Although many ideas and techniques originate on the so-called "big jobs," the basic principles involved can be adapted economically to smaller projects.

The contractor is not alone in his quest for new ideas and techniques. Tool and equipment manufacturers are backing him with improved product designs aimed at cutting installation cost. Better mounting facilities, more work space and better accessibility for maintenance are prominent factors which indicate a growing respect for contractor field problems.

CUTTING KNOCKOUTS—HOURS EACH

SIZE	WITH HAND CUTTER	WITH HOLE SAW	WITH HYDRAULIC CUTTER
½"	0.20	0.15	0.18
¾"	0.25	0.17	0.21
1"	0.27	0.20	0.21
1¼"	0.29	0.22	0.21
1½"	0.31	0.25	0.21
2"	0.40	0.30	0.25
2½"	0.47	0.40	0.30
3"	0.55	0.50	0.35
3½"	0.65	0.60	0.40
4"	0.75	0.70	0.45

NOTES: ½-in. pilot hole drilled for hand and hydraulic methods.
Electric drill used for pilot holes; double units if no electric drill is used.
Cost of hole saw included.
Source: Electrical Construction Cost Manual—McGraw-Hill Book Co., Inc.

TOOL INVENTORY

Abrasive wheels--metal cutting
Band saws, metal cutting, power operated
Benders, pipe and tubing, mechanical, hydraulic, manual and power driven, large and small
Cutters, conduit, tubing--hand and power operated
Hacksaws--hand power operated
Hickeys and ratchet benders
Hole saws
Knockout punches, hand, hydraulic--standard, C-clamp
Power drive, universal for cutting, threading, reaming pipe
Power drive adapter--attachment to pipe threaders for large conduit
Pushers, pipe, hydraulic--manual and power driven
Reamers, pipe
Stocks and dies--various sizes
Threader, pipe, manual and power driven
Threading machines, pipe, power driven
Vises, pipe, yoke and chain
Wrenches, pipe, chain tongs, adjustable, Stillson

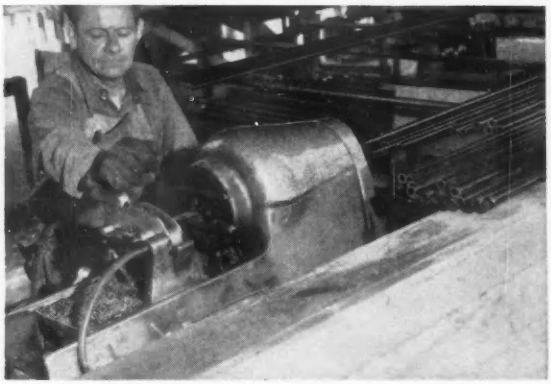
1962 TOOLS AND METHODS

CONDUIT AND RACEWAYS

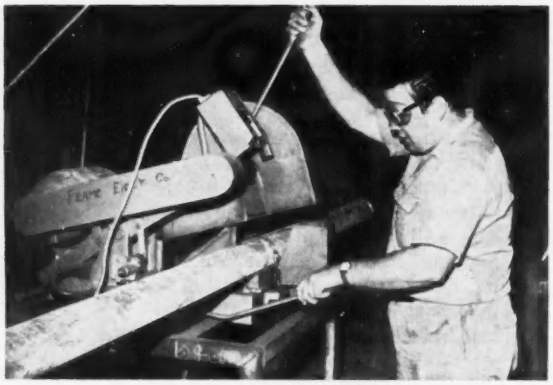
MODERN power tooling has eliminated most of the effort and fatigue formerly associated with conduit and raceway fabrication. Today, expended manhours are a factor of a machine's capabilities rather than a mechanic's physical capacity and stamina. Now, the mere flip of a switch or lever gets the job done. Current tool design and improvements feature speed, accuracy and simplicity.

One of the most versatile of pipe tools is the power drive. By securely gripping and rotating conduit and pipe, it has practically "mechanized" a variety of hand threading, cutting and reaming tools. In fact, it has rapidly become the key power tool around which shop and field fabrication centers—small and large—have been built.

Methods of cutting conduit range from the standard hand hack saw to the speedy metal-cutting band saw. Even more efficient, in some cases, is the high-speed abrasive cut-off wheel familiar to industrial operations. The current trend, as noted in a previous section, is to mass produce electrical system assemblies in a centralized fabrication area, then distribute these to installation points. Housing, apartment and other projects with a multiplicity of identical conduit

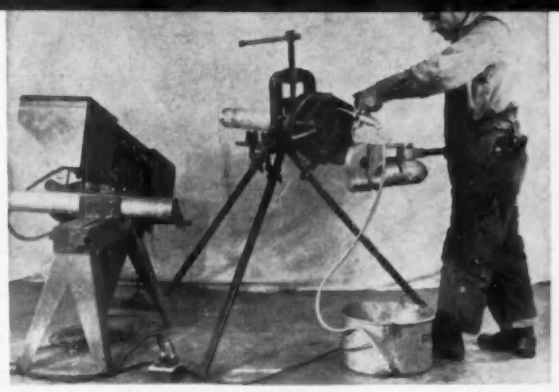


PRODUCTION LINE THREADING of precut conduit saves time at contractor's site fabrication center. Cutting and bending work stations are also in immediate area.

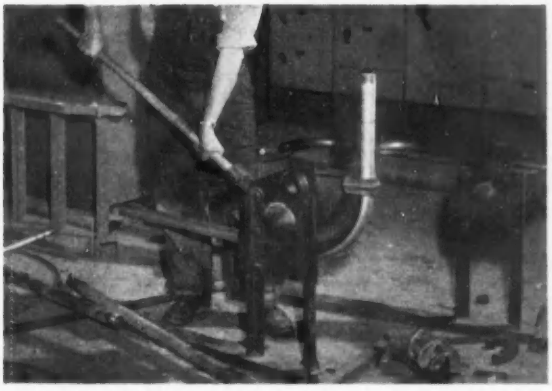


ABRASIVE CUT-OFF saw slices through metal conduit in a matter of seconds; speeds electrical raceway fabrication and installation.

MASS CUTTING of bundles of EMT with portable metal-cutting band saw. Tape straps on each side of cutting mark hold bundles together during and after cut. Tubing connected continuous rows of fluorescent strip lighting.



PORTABLE POWER DRIVE operates threading unit for large conduit; has own threader attachment for small conduit; can be used to operate winch drums, augers, etc. Band saw at left slashes pipe cutting time.



PEDESTAL BENDER increases accuracy and efficiency of on-the-spot hand bending of conduit. Some units have ratchet action; all operate on simple lever principle.

ONE-SHOT OFFSETS made with this twin-shoe, power-driven, multi-purpose hydraulic bender increased accuracy and drastically cut bending time on a large project.

runs present a "natural" field for this type of operation. On some projects, mechanics were seen cutting whole bundles of small conduit and tubing with one setting of a metal-cutting band saw. For cutting large size conduit, the band saw has almost universal acceptance in the trade; is about ten times faster than a reciprocating power hack saw. It is not unusual to find two, three or more band saws on a single electrical job.

Hand methods are still used on jobs which, in the contractor's opinion, do not merit a high degree of mechanization. Even here, the addition of lightweight, easy-to-move power drives provide a substantial degree of mechanization and cost reduction on the small project.

Conduit threading is another operation in which considerable progress has been made. Today power units are available to solve practically every threading problem and in price ranges to fit the tool budget of all contractors, large and small. Conventional threading machines are now much lighter in weight and easier to transport; do a more efficient cutting and threading job; find ready application in contractor field shops where mass fabrication operations are necessary.

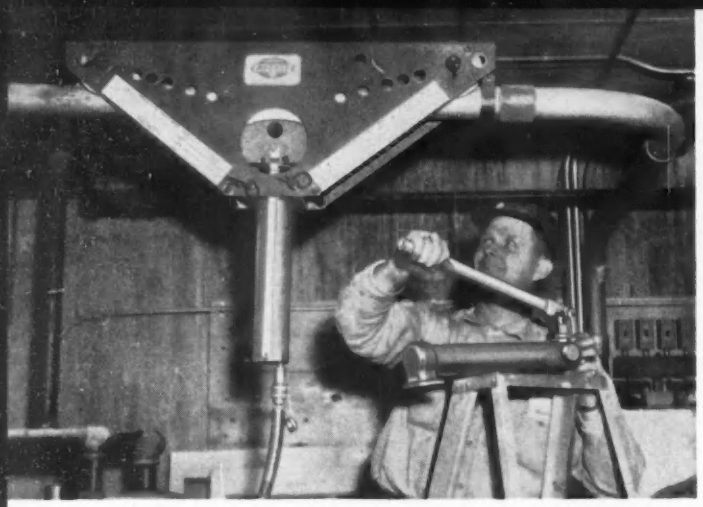
For field threading at point of installation, lightweight (20 to 26 lbs) hand-held, portable threaders are used extensively. These handy, reversible-motor units can be used with a series of adapters to operate dies and conventional geared threaders for up to 6-in. conduit; have attachments to drive cable winches and earth augers. Another advantage is that they can efficiently thread "in place" conduit either overhead, in trenches, or wherever a 12-in. work space is available to the mechanic.

A recent development in the pipe tool field simplifies threading large conduit. Known as a close-coupled drive, it involves a set of attachments that permit operating geared threaders without the conventional universal drive shaft. Instead, the threaders are attached to a power drive with adapter brackets and a short drive bar. In operation, the threader remains stationary on the power drive while the conduit turns on a roller yoke support. Biggest advantage of this technique: considerably less space and much shorter set-up time are required.

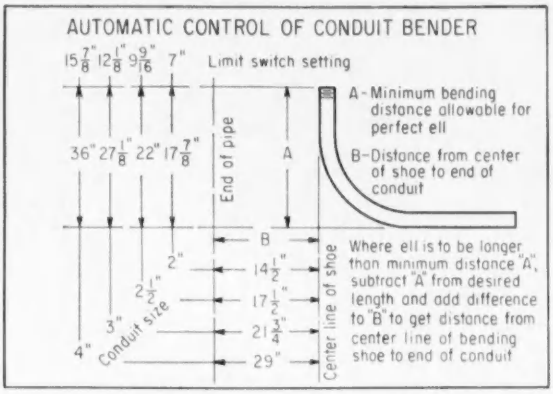
Continuous developments in the threading tool field have reduced threading time to an absolute minimum. In the process they have converted what was once considered a "rough" job to practically a push-button operation.

The same can be said of conduit bending—if proper equipment is used. The addition of power pumps, angle-gauges and bending data charts to hydraulic bending equipment has simplified the operation and has made heavy conduit bending a "watching" rather than an arm-weary "pumping" chore. Bends can now be made up to three times faster than with the hand pump. Development and refinement of the "one-shot" 90-degree bender (longer ram travel and special shoes) have drastically cut actual bending time (4-in. conduit, one minute or less).

One of the most recent additions to the hydraulic bender line is a



IN-PLACE BENDING of conduit is possible with lightweight hydraulic benders; saves time and material costs where rotation of off-set conduit is impossible. Note bending charts and ram-travel gauge on unit.


AUTOMATIC CONTROL OF CONDUIT BENDER
15 7/8" 12 1/8" 9 9/16" 7" Limit switch setting
36" 27 1/8" 22" 17 7/8"
End of pipe
A
A - Minimum bending distance allowable for perfect ell
B - Distance from center of shoe to end of conduit
B
2"
2 1/2"
3"
4"
Conduit size
14 1/2"
17 1/2"
21 3/4"
29"
Center line of shoe
Where ell is to be longer than minimum distance "A", subtract "A" from desired length and add difference to "B" to get distance from center line of bending shoe to end of conduit

GUIDE CHART establishes limit-switch settings on large hydraulic bender with power pump operation. Automatic control saved time on project requiring repetitive identical bends in various sized conduits.

dual purpose unit that makes offsets in seconds with one setting and a single ram stroke, one-shot close-to-the-end 90° bends, and 180° bends in a simple two-stage operation. Hydraulic power pumps are becoming smaller and lighter in weight. One available unit weighs only 14 lbs, can be carried anywhere and can also be controlled by a remote cord.

In fact, the increased efficiency of conduit bending equipment has led many contractors to substitute field bending of conduit for manufactured elbows and offsets. Mobile platforms or "bending tables" frequently are used to support one or more hydraulic benders to meet job requirements.

Since fewer cuts, threads and couplings are needed, over-all raceway installation time is substantially reduced. To this can be added the saving of waste conduit pieces.

An actual project case study dramatically illustrates the economics involved. A motor-operated, "one-shot" hydraulic bender was used to fabricate 273 90-degree bends in 2-in. through 3½-in. conduit (about one-half of the bends were in 2½-in. conduit). Comparative installation costs showed a contractor estimated savings of some $2,300 (an average of about $8.50 per bend) over use of factory elbows. According to records, about 60% of this over-all saving was reflected in labor.

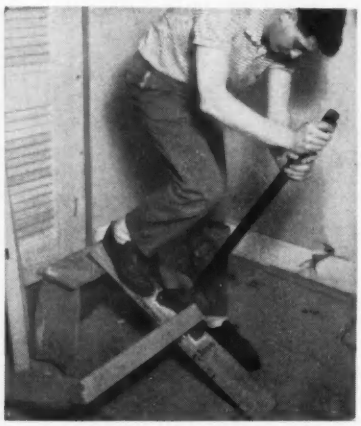
On another project involving a multiplicity of duplicate bends, the contractor's field superintendent practically "automated" the operation. He installed a limit-switch system which automatically stopped ram thrust at predetermined points to make the proper bends. To help mechanics make perfect 90-degree bends in different size conduit, he developed a chart showing limit-switch settings for each conduit size involved.

The use of lighter metals in modern bender construction is a definite advantage to field efficiency. Most sizes can now be transported by one man and even carried up a ladder for overhead bending of "in place" conduits. This latter approach is particularly time-saving on parallel conduit runs where space limitations prevent normal rotation of prebent sections during the coupling operation.

Hand, foot and power pumps also are used on a series of hydraulic knockout punches for cutting conduit openings in metal enclosures. Latest development in this field is a "one-shot," lightweight C-clamp type punch with an 8-in. deep throat which fits around the edge of a box or "tub." Tool has spring-return ram for fast operation; eliminates predrilling and step-up punching operations normally required.

Where bending is confined to smaller conduit, hand benders (1½-in. or less) and hickeys (1-in. or less) are still considered the most efficient tools. This is particularly true for on-the-spot bending where offsets must meet construction requirements.

Even where mass bending techniques are essential, hand benders (for smaller sizes of conduit and tubing) can often be used to an advantage.



CUTTING SHEARS on wood base, designed for specific type of surface metal raceway, slashes up to one-third off normal raceway cutting time. Portable unit has 30-in. handle for cutting ease.

PORTABLE BAND SAW makes fast accurate cuts on underfloor duct sections field-tailored to meet installation requirements. Unit also is used to cut conduit, channel and angle-iron.

COMPARATIVE INSTALLATION COSTS
MANUFACTURED ELBOWS VERSUS FIELD BENDING OF CONDUIT

Conduit Size	INSTALLATION COSTS—Dollars						SAVINGS THROUGH FIELD BENDING—Dollars		
	Manufactured Elbows			Field Bending			Per Elbow	No. of Bends	Total Savings
	Elbow and Coupling	Labor	Total	Material	Labor	Total			
2″	$2.05	$4.68	$6.73	$0.88	$1.44	$2.32	$4.41	50	$220.50
2½″	3.78	6.37	10.15	1.65	1.80	3.45	6.70	123	824.10
3″	6.34	8.42	14.76	2.25	2.02	4.27	10.49	60	629.40
3½″	11.39	10.37	21.76	3.05	2.56	5.61	16.15	40	646.00
							Total Savings		**$2,320.00**

NOTES: While this evaluation was made on a new hospital project about five years ago, a similar relationship between the two techniques would exist under 1962 prices.

Source: Dietz Electric Co., Inc., Milwaukee, Wis.
Blackhawk Industrial Products Co., Butler, Wis.

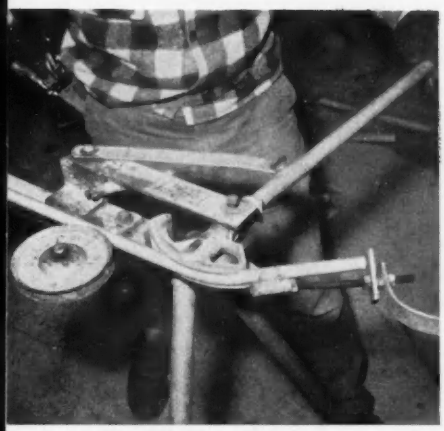
BENDING PRESSURES (LBS) AND RAM TRAVEL (IN.) FOR ALUMINUM CONDUIT

	15° Bend		30° Bend		45° Bend		60° Bend		75° Bend		90° Bend	
CONDUIT SIZE	Pressure	Travel	Pressure	Travel	Pressure	Travel	Pressure	Travel	Pressure	Travel	Pressure	Travel
1½″	100 lbs.	2¼″	200	3⅜″	220	4⅞″	250	6⅛″	275	7¼″	300	8½″
2″	200	2½″	225	4″	300	5-7/16″	375	6⅞″	400	8″	425	9¾″
2½″	400	2-11/16″	500	4⅜″	600	6″	650	7⅝″	700	9⅛″	800	10-7/16″
3″	600	3″	700	4-15/16″	800	6¾″	900	8½″	1000	10″	1200	11½″
3½″	700	3½″	800	5-9/16″	1000	7⅜″	1200	9½″	1300	11-3/16″	1400	12¾″
4″	1000	3-9/16″	1100	6⅛″	1300	8⅛″	1600	10⅛″	1900	11-15/16″	2350	13-9/16″

Center Radius of the Shoes and Center to Center of Pipe Supports

Conduit Size	Center Shoe Radius	Center to Center Pipe Supports
1½″	8¼″	23.62″
2″	9½″	27.62″
2½″	12½″	31.62″
3″	15″	36.00″
3½″	17½″	40.00″
4″	20″	44.00″

NOTES: Data taken with a Greenlee No. 884 power driven hydraulic conduit bender.
Source: Greenlee Tool Co.; Kaiser Aluminum & Chemical Sales, Inc.



BENCH BENDER on conduit horse, designed around conventional tubing bender, permitted mass production of EMT offsets (90° and 45°) for apartment house electrical installation.

OFFSET TOOL for EMT entrances into switch and outlet boxes forms both bends of the offset simultaneously and in about two seconds. A handy time-saving tool for electrical metallic tubing work.

PEDESTAL SUPPORT raises one-shot hydraulic bender to convenient working height; eliminates mechanic fatigue and cuts over-all bending time. Note angle-gauge on bender which is power operated.

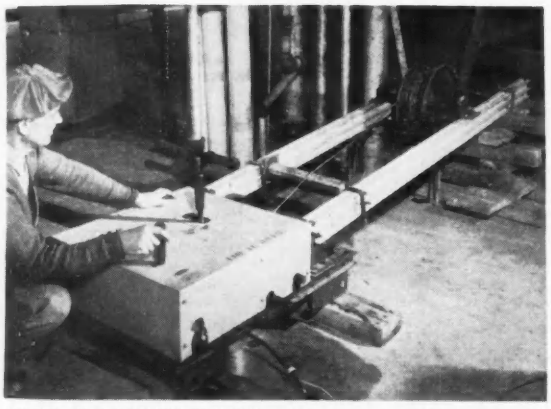
TOOL INVENTORY

Blocks, snatch
Block and tackle
Brakes, cable
Cable lubricants
Cable marking labels
Connectors, wire cable--solder, solderless, bolted, compression type
Conveyors, roller type for pulling cable
Compressors, air
Crimping tools, cable, wire--mechanical, hydraulic
Cutters, wire, cable--mechanical, hydraulic
Grips, wire and cable, basket mesh, comealongs
Insulating sleeves
Jacks, screw, reel, gang, payout, manual, hydraulic
Knives for stripping cable insulation
Measuring machine, wire, cable
Pullers, cable--mechanical, power drive
Pulleys and sheaves for cable and wire
Plow, cable laying
Reel trailers, carts
Re-reeling equipment
Rope, hemp, steel
Rollers, reel
Rollers cable--for pulling cables on racks or in troughs
Saws, hack
Solder
Soldering pliers, electric
Soldering devices, chemical
Solder paste, irons, pot ladle
Splicing tools, kits, compound
Strippers, wire
Tape, fish, steel
Tape, insulating, rubber, friction, plastic, varnished cambric, linen, cotton, asbestos
Torches, alcohol, gasoline, soldering, gas
Welding equipment
Winches, hand and power driven

CABLE HANDLING

CONDUCTOR or cable installation can be an easy, difficult, simple or complicated operation depending upon the type of equipment and field techniques employed. Prime consideration in all cable work is to prevent damage to insulation or protective sheath during installation. This applies to all conductors whether they be in exposed or concealed conduit, ducts or wireways, or supported in open air by insulators or cable troughs.

Among the many factors influencing cable installation methods are: raceway system design; number, location and size of pull and junction boxes; length of raceway; number and type of bends; size, weight and number of conductors or cables; available space for reel and winch setups; limitations of the cable-handling tools and equipment on the job. Choice of equipment and technique is a responsibility of the electrical contractor or his field superintendent.



PORTABLE POWER WINCH with dual-speed drive with adjustable boom and pulley braced over riser shaft pulls feeders up 26 floors from basement reel setup. Wheels were detached for stability.

VACUUM SUCTION PADS anchor compact gasoline-powered cable winch. Rope around slip-clutch capstan gives mechanic "feel" and full control of cable pulling operation. Thus, the pulling can be stopped quickly in an emergency.

Installation methods are many and varied; are normally tailored to the specific project at hand. For multistory risers, two techniques are available. Where space, floor design and hoisting facilities permit, cable reels can be set up on the top floor with the winch in the basement. This method takes advantage of cable weight and gravity pull, reduces capacity of winch required, and may cut pulling time considerably. However, a well-coordinated reel-braking system should be used to prevent cable "run-way" and possible snagging and insulation damage. The other method, considered by many contractors to be the safest and easiest controlled, is to reverse the procedure and pull up against cable weight. Proponents of this technique point out its inherent safety, although it may increase pulling time.

For horizontal runs, the straight-through pulling technique has become an accepted method of cutting man-hours from cable installation time. With one reel and one winch setup, conductors are pulled "straight-through" junction boxes from one end of the conduit run to the other. Right-angle turns can be incorporated in the single pull if offset boxes of sufficient sizes are installed (an important design consideration). When this is done, the conductors pass around a large-diameter, wide-face, relatively shallow pulley anchored inside the box. Contrast this with the conventional method of pulling at the pull-box, feeding the conductors back in again and pulling at the end of the run. The latter requires two winch setups and the time of a crew paying-out and feeding the conductors at the pull-box. Cost savings are obvious.

With the aid of pulley assemblies at turns and strategically spotted detachable rollers along the line, the same straight-through method can be applied to interlocked armor and insulated multi-conductor cables installed in cable trays or racks. Continuous runs of 500 ft, 750 ft and more have been installed in this manner.

Maintaining a steady pulling tension and constant speed to keep cable in continuous forward motion is an acknowledged "must" for successful conductor installation. If the pull is made in "hitches" with intermittent stops, the forward motion advantage is lost. After each stop, the inertia and frictional resistance of the cable deadweight must be overcome. That is one of the reasons why the power winch has become such an effective tool. A combination of careful cable payout, application of proper cable lubricants and modern high-capacity winch equipment will generally permit uninterrupted continuous-pull operation.

Pulling equipment varies with the size and type of job. It can range from the conventional fish-tape pullers for small circuits to hand-operated clamp-on winches and power winches operated either by conventional power units or built-in integral motorized equipment. Where working conditions permit, truck winches are still used effectively.

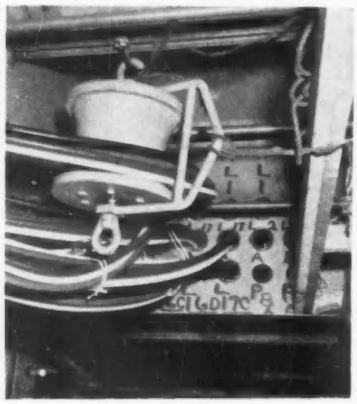
Next to capacity, important factors in winch selection are portability and setup ease—two items which can substantially affect installation man-hours. One unit, considered most efficient from an overall standpoint by a number of contractors, is a mobile (four detachable wheels) motorized heavy-duty winch with a multispeed drive and an adjustable boom and pulley attachment to meet practically all cable installation problems.

Recent addition to the cable winch line is a contractor-designed compact unit with balloon-tire wheels, vacuum-type suction cup

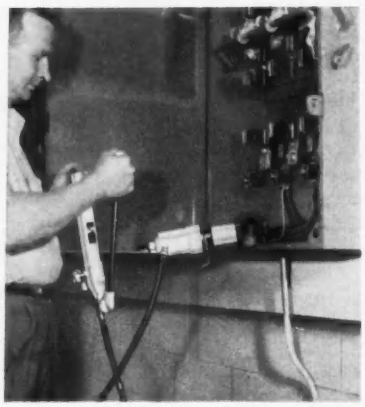
VERSATILE FORK LIFT truck doubles as a cable pulling "tool". Pulling rope can be attached to truck rear, or motorized winch on lift rails in front can be used and raised or lowered to convenient pulling position.

PEDESTAL WINCH with rope-sling anchor is operated by a portable power drive, which also can be used for conduit threading. Here, mechanics are pulling feeders into distribution side of a unit substation.

ROLLER FRAME is placed over an indoor manhole to simplify and speed up the installation of cables. In addition, this technique prevents damage to conductor sheaths and permits cable to be fed from either side.

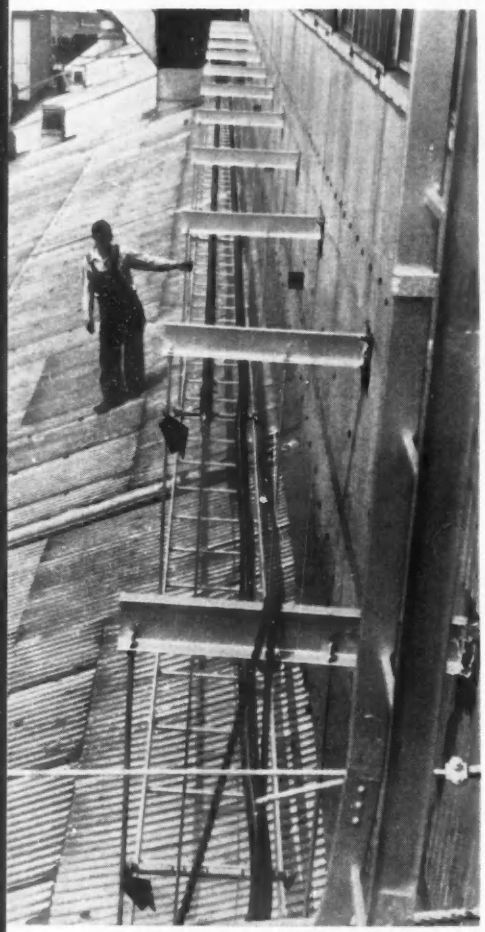


SPECIAL PULLEY in large right-angle pull box permitted continuous pull of feeder cables around 90° bend; eliminated duplicate winch and feed-in operations; solved space problem on crowded floor below.



CABLE CUTTER, operated by hydraulic ram, nips large cables in a matter of seconds; works well in close quarters; is a handy accessory for hydraulic hand and power pumps.

CABLE BENDING TOOL designed by contractor permits fast "tailored" training of heavy cables in tight quarters. Yokes and hooks on tool seat and grip cable.



DETACHABLE ROLLERS on ladder racks (arrow) in combination with pulley assemblies at turns facilitate continuous-pull of long runs of interlocked armored cable feeders; cut installation time drastically.

SPLICING JIG, built by contractor, securely positions and holds conductors for butt-end splice; raises conductors to convenient working height for one-man operation. Here, packaged splicing kit is being used.

CABLE TERMINATION is a "snap" with compression lugs and foot-operated, hydraulic compression tool. Same technique can be used with splices using compression connectors.

anchors, and a slip-clutch capstan around which the pulling rope is wound. The pull is controlled by the mechanic on the rope who can "feel" snags or excessive tension and take remedial action before cable damage occurs. The winch is powered by either an electric or gasoline motor.

Add to this the number of different power drives for lighter winches and you have impressive array of equipment available for contractor use.

Numerous advances have been made in the art of "fishing" conduits and ducts. The steel fish-tape is still an important tool for relatively short runs. On longer conduit runs, compressed-air devices —"parachute" for larger pipes and a cloth doubling as a swab for smaller conduits—force a fish line through in a matter of seconds. Most recent addition to this group of time-saving devices is a gun-fired, jet-propelled cartridge which pulls a strong nylon cord through the raceway, bends and offsets included. The cord is then used to hand-pull a fish-rope through the conduit. Choice of method still depends on the job conditions and "tools" at hand. The trend is definitely toward cutting this time-consuming installation chore to an absolute minimum.

Reel handling—spotting and payout—is another operation which has become highly mechanized.

STRIPPING TOOL for MI cable quickly cuts and spirals copper sheath. Other special tools speed installation of MI fittings and termination seals.

TRANSPARENT MOLDS are latest improvement in epoxy resin splicing methods. Mechanic can quickly position mold over splice and inspect resin flow during pour.

HAND-OPERATED, completely insulated, hydraulic tool cuts connector installation time to a matter of seconds. Handy pocket gauge checks wire size for quick lug selection.

MASS CUTTING of nine conductors at once with foot-operated shear. Stripping machine in foreground has round, heated blades which nick, melt and strip conductor end insulation in single, fast operation. System was used on a 24,000-fixture lighting installation.

REEL CART holds twelve 2500-ft reels of branch-circuit conductors; will pass through doorways; has payout guide-bars on front and back; was designed by contractor to speed branch-circuit wiring in apartment projects.

Many contractors find it more economical, both from a cost and time standpoint, to reel cable for specific job needs from their own cable stock. Some have built their own motorized re-reeling machines with single or partitioned (for more than one conductor) reels for field use. Others use units already on the market. In any case, cable is passed from stock reels through a cable-meter to the reeling unit to assure accurate lengths. Where time is not so important, and required cable is not in stock, contractors frequently order cable factory-cut and reeled (one or more conductors per reel, as required) for direct delivery to the job site.

In the cable termination and connection field, considerable progress has been made in the development of time-saving tools and equipment by manufacturers and contractors. Tool items run the gamut from mechanical cutters and indenters (for small conductors and lugs) to hydraulic cutters and compression tools (for large conductors) for use with the popular compression type connectors and lugs. With this equipment, cable termination and connection time are reduced to a matter of a few seconds or minutes.

Availability of complete splicing kits, including the poured epoxy resin type with plastic mold, eliminates material waste while drastically cutting splicing time and assuring a trouble-free connection.

Contractor ingenuity also contributes to cable installation economies. A representative example is a project on which the electrical contractor developed a set of cable bending tools to accurately train large cables in confined quarters in switch cabinets and other enclosures. For straight-line, butt-end splicing of heavy conductors, he built a cable-jig to securely position and hold the cable ends together. Net result was greatly decreased splicing time.

And, on all cable work, the use of conductor and circuit identification tags and labels simplifies installation checks and cuts time-consuming tracing for subsequent maintenance operations.

TOOL INVENTORY

Air compressors, gasoline driven
Air hammers, drills and complement of air tools
Augers, various sizes and sectionalized lengths
Bulldozers, tractor-shovels, for backfilling trenches and excavations
Benders, pipe, hydraulic--hand, power
Blocks, snatch
Block and tackle
Braces, trench, adjustable
Bullpoints
Chains
Crowbars
Digging machines, clamshell scoop, trenchers, back-hoe, tractor-shovel
Generators, portable, gasoline driven
Goggles, safety
Gloves, safety
Jacks, screw, hydraulic--manual, power
Levels, carpenters, surveyors
Picks
Pinch bars
Plow, cable laying
Power drives, portable, for winches
Pulleys and sheaves
Pushers, pipe, hydraulic--manual or power operated
Reel trailers and carts
Rollers, cable protection at manholes
Rope, hemp, wire
Saws, wood, rip, crosscut, masonry
Sledge hammers
Shovels, long and short handled
Tampers, hand, power-operated, pneumatic
Tape, fish, steel, manual, pneumatic
Torches, gas, acetylene, cutting, welding
Tongs, chain
Trenchers, jeep attachment, conventional self or hand propelled, heavy-duty
Trailers, highway type for storing tools and materials, low boy for hauling slow moving mechanized equipment
Trucks, standard, heavy duty, winch, reel, sand spreader
Welding equipment
Winches, power operated
Wrenches, pipe, chain, adjustable, Stillson

UNDERGROUND WORK

UNDERGROUND electrical work normally involves some method of excavating and trenching for ducts, manholes, direct-burial cables, openings for pipe-pushing equipment, lighting standard bases, or similar facilities. Since the man-hour differential between hand labor and machine operation is so great, almost all trenching, excavating and backfilling is now done with power equipment.

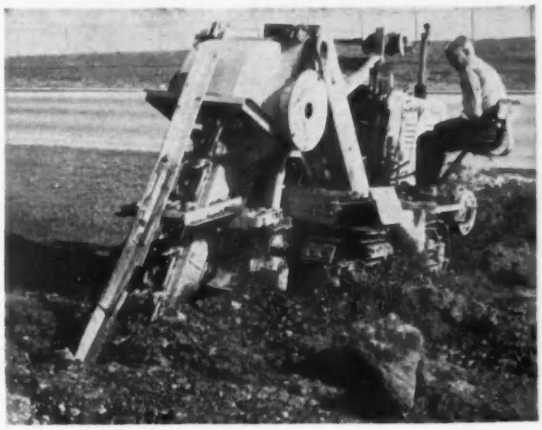
To take advantage of this labor-saving method, electrical contractors acquire trenching equipment for temporary or permanent use. Some, engaged in intermittent underground jobs, find it economical to rent equipment for a single project or limited use on a number of current projects. Others, who normally specialize in this field or anticipate substantial future work of this type, purchase such equipment outright even though the initial investment is substantial. Realistic tool-cost charges against individual job use result in a reasonable write-off period.

Some electrical contractors find it to their advantages to lease this type of power machinery on an annual or long-term basis. Regardless of how it is acquired, firms with such equipment available at all times find themselves in a much better competitive position when figuring underground work.

Selection of equipment depends on the size of the construction project and the specifics of the under-

CABLE PAYOUT for direct-burial street lighting circuits is simplified by mounting six reels on truck bed. Truck moves slowly along highway as mechanics unreel required conductors and lay them in trench.

HEAVY DUTY TRENCHER cuts clean 10-in. by 30-in. trench in highway shoulder for lighting system. Under normal conditions, operator can cut up to 350 ft of trench per hour.



CAT TRENCHER is highly maneuverable; works well on straight-away or lateral connecting trenching; cuts up to 250 ft of trench per hour, depending on depth and soil.

ground system requirements. Large trenching and excavating machines are not always necessary. Much of the electrical contractor's trenching can be done with the lighter self-propelled trenching units or jeep trenchers (jeep truck with trenching attachments). The latter have the advantage of job-to-job high-speed highway travel under their own power.

The current trend toward greater use of direct-burial cable and underground electrical service to homes, recreational fields, drive-in theaters, etc., has created a demand for light- and medium-weight trenching units. Several types are available. Some are hand-propelled; others, self-propelled. Weights start at about 242 lbs and go up; trenching speeds vary from 2 ft to 15 ft per minute, or more, depending on soil conditions and trench depth. Trench widths range from 2 in. to 12 in.; depths from 2 ft to 6 ft or more. Attachments for this line of trenchers include "dozer" blades for backfilling and even a boring attachment to get under pavement crossing trench lines. Units can be trailer-transported or easily loaded on conventional pick-up trucks.

Intermediate size units are recommended for tough soil conditions and exceptionally long trenching assignments. And heavy-duty trenchers are normally used on highway lighting projects, where miles of trench must be dug in conventional fill used for road building.

Backfilling of trenches and excavations is a highly mechanized operation with the bulldozer and tractor-shovel favorite equipment items. One man on such a unit can do the work of eight to ten laborers. On a residential street lighting project with an inside-the-curb trench, one contractor solved backfilling by using a midget bulldozer with rubber treads that would not damage the walk or lawn area.

HAND-PROPELLED bantam-size trencher digs 3-in. swath up to 32-in. depth at speeds up to 10 ft per minute. Lightweight and portable, it works well on short-run trenching of lawns, etc.

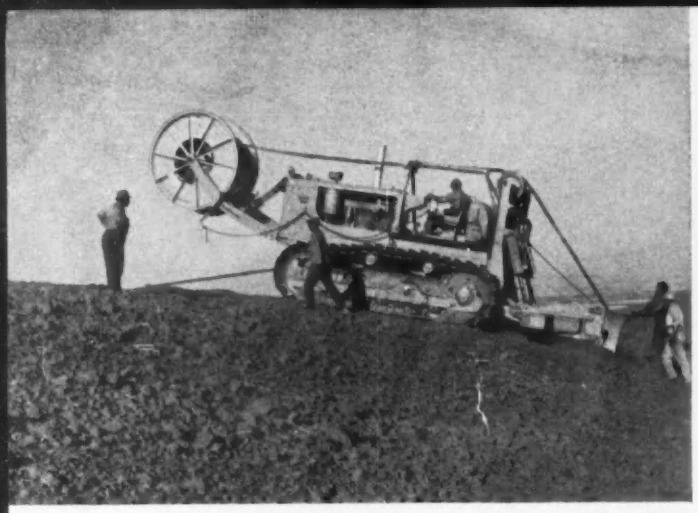
SELF-PROPELLED medium-weight trencher has four digging speeds; cuts trenches (4 in. wide to 6 ft deep; to 12 in. wide, 3 ft deep) at speeds ranging from 2 ft to 15 ft per minute.

When direct-burial cables are installed, backfilling must be done more carefully to prevent stone and rock damage to the cable. Normally cables are nested in and covered with a layer of sand, or covered with creosoted planking before the fill as replaced.

On a street lighting project, trench sanding time was drastically cut by using a sand spreader (hopper truck) which moved along the highway parallel to the trench. A lateral belt conveyor on the back of the truck bridged the space between trench and truck; deposited a 4-in. layer of sand in the bottom of the trench. The truck followed the trencher, then made a second pass after the cable had been installed.

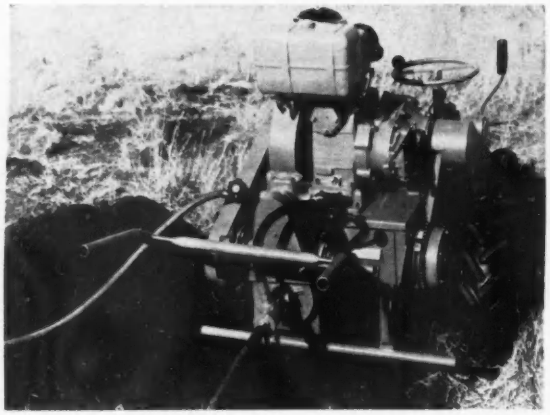
On many projects, specified compactness of trench backfill must be met. To accomplish this, contractors use power-operated tampers (pneumatic or gasoline-engine operated) on specified layers of trench fill before final grading.

Recent development of a unit-type, conduit-cable assembly for underground street lighting circuits shows promise of substantial installation economies. Circuit conductors are factory-assembled in a semi-flexible plastic conduit and delivered to the job on a large-diameter reel ready for direct-burial as a single unit. Specified lengths may be precut, end-sealed, and reeled at the factory for quick installation between lighting stand-



CABLE-LAYING TRACTOR plows deep furrow and lays 3-in. cable in single operation. Hydraulic reel arms in front raise and support reels for cable payout. Cable boot in giant ripper blade at back of tractor continuously feeds cable into furrow.

ONE MAN can shove conduit under a roadway by manipulating a couple of levers controlling hydraulic pipe pusher. No street trenching is needed. Gasoline-motor driven hydraulic power pump is on mobile undercarriage.



BORING ATTACHMENT increases versatility of self-propelled, medium-weight trencher; permits in-line boring under roadways, sidewalks and other obstructions crossing trench line. Unit bores holes up to 4 in. dia., 100 ft long.

BACK HOE on tractor-shovel excavates for street lighting standard bases and for pipe-pushing equipment at points where circuits go under roadway. Same unit is used for backfilling and grading.

ards. With the plastic conduit protection, contractors see fewer—if any—of the callbacks experienced with direct-burial cable inadvertently damaged by stones and sharp objects in trench backfill.

On projects requiring underground raceways, plastic conduit is joining the ranks of fiber conduit and other non-metallic ducts as an economical system. The combination of lightweight, long lengths (10 ft, 20 ft and 30 ft) and quick cemented joints offer many time-saving advantages.

Digging, like trenching, is now a machine job. One man operating a power-digger can excavate for pipe pushers, manholes, etc., in a matter of 10 to 15 minutes or more, depending on size of hole required. Of the variety of equipment available, the tractor-shovel with a back-hoe has become a favorite with the electrical contractor. When the rear-mounted, hydraulically operated back-hoe is not being used for digging, the front-mounted hydraulic shovel can be used for backfilling, grading or loading excess fill on trucks. Even some of the intermediate size trenchers are now being equipped with a back-hoe. Such equipment versatility arouses a contractor's interest. It means fewer machines are needed to get the job done; more use of machines; and a smaller capital investment in equipment.

Well-equipped contractors also recognize the advantages of having air compressor trailers with a complement of pneumatic tools and accessories. Included are such items as air hammers, soil tampers and earth augers of various types.

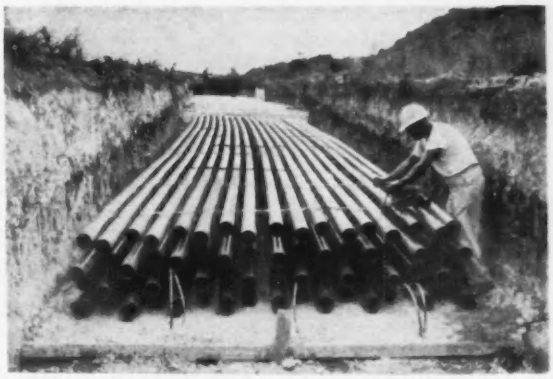
Where conduits must be installed under existing roadways or sidewalks, a hydraulic pipe pusher is usually the first "tool" to be considered. Recent improvements and refinements of hydraulic power pumps (both gasoline and electric motor powered) have slashed the "pushing" time considerably. Greater speed range, faster ram approach, and higher pressures are now available on units that can be mounted on a rubber-wheeled undercarriage for job mobility. While hydraulic pushers can operate in most soil or fill compositions, hard packed sand fill presents an obstacle. When this is encountered, contractors have effectively used compressed-air rotary drills with auger attachments to tunnel through the fill before installing the conduit.

PNEUMATIC AUGER bores under sidewalks and driveways for installation of direct-burial street-lighting cable. Nine-ft auger is made up of coupled sections; works faster than pipe pusher for this specific job.

TAMPING TRENCH backfill to specified compactness with gasoline-engine-operated tamper. Contractors with air compressor equipment use pneumatic tampers.

BANTAM BULLDOZER has rubber "cat" treads to prevent concrete damage; rides sidewalks to backfill street lighting trenches; does the work of eight to ten laborers. Light trailer furnishes highway transportation.

MOBILE WINCH, with gasoline-engine power, has carriage overhang and shaft extension to center capstan drum over manholes or conduit stubups. By reversing rope hitch on drum, mechanic can pull from two directions.



STEEL BANDS are fastened around 68-duct bank of fiber conduit with conventional strapping tool. Technique keeps ducts from shifting or floating during concrete pour.

Cable handling and winch equipment for pulling in underground conductors are, with few exceptions and possible refinements, similar to that used on "inside" work. Outdoors, truck winches and gasoline-powered individual units predominate.

Field observation indicates that contractor ingenuity plays an important role in the development and application of time-saving techniques. Here is a typical example. To facilitate cable pay-out, one firm designed and had built a special reel-truck with hydraulically-operated "arms" to suspend cable reels over manholes. Repeated set-up time was eliminated and the truck could move quickly, over rough terrain, from one feed-in location to the next. With an integral winch and re-reeling attachment, the truck could be used for cable pay-out, cable pulling, or removal of cables.

Even a casual observation of current underground electrical installation projects reveals this important fact: Mechanization is the key to economical operations.

TRENCHING—Cost per Foot in Dollars

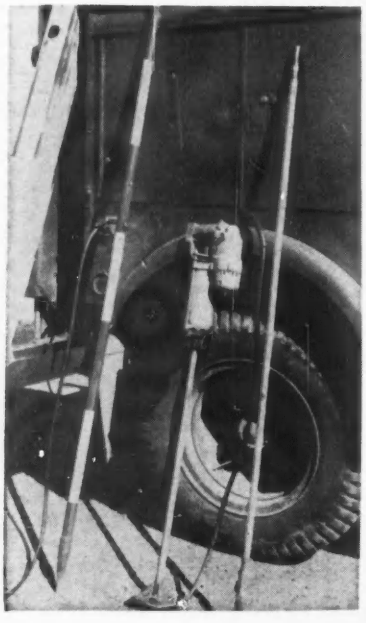
METHOD	COST, $
MACHINE TRENCHING—Continuous trench in normal soil	
Up to 500 ft	0.10
1,000 ft	0.07
3,000 ft	0.06
Over 3,000 ft	0.055
Notes: 6″ trench, 4′–6″ deep; 8″ trench, 4′ deep; 14″ trench, 3′–6″ deep. Add 10% for excessive short runs.	
HAND TRENCH—Spade width, 3-ft deep	
Common Labor ($1.75 per hour)	0.60
Electrician ($3.00 per hour)	1.00
PUSHING CONDUITS—Hydraulic	
3″ or 4″ galv. rigid conduit (est. 0.65 hr/ft)	1.90

Source: Electrical Construction Cost Manual—McGraw-Hill Book Co., Inc.

TOOL INVENTORY

A-frames
Augers and diggers, pole hole
Augers, pole hole, truck mounted
Bars, metal, tamping and digging
Belts, linemen's
Blankets, rubber
Block and tackle
Borers, earth
Buckets, canvas tool
Cant hook
Cars, cable stringing
Cutters, wire, cable
Derrick trucks, pole setting, digging
Drills, impact tools, electric, air
Drivers, ground rod, guy anchor rod
Flares, linemen's
Gin poles
Gloves, linemen's
Gloves, rubber
Grips, wire and cable
Hoists, pole top, adjustable transformer, ratchet lever
Hand Lines
Jacks, pole pulling
Jenneys and mules, pole
Ladders, aerial
Live line safety tools
Measures, pole
Pike Poles
Pruning tools
Pulleys and sheaves, wire stringing
Pullers, slack
Reel carts
Rope, hemp, steel
Saws, power chain
Shovels, pole hole and spoons
Splicing tools
Spurs, linemen's climbing
Tension indicator dynamometer--wire tension
Towers, hydraulic
Trailers, reel, pole, dolly
Tractors
Trucks, line, service, ladder
Wrenches, assortment

POLE AND LINE WORK



ELECTRIC HAMMER, with a complement of digging and tamping accessories, is a handy tool to have on a line truck. Unit plugs into electric outlet on side of truck.

POLE and line work is becoming an increasingly important part of an electrical contractor's over-all operation. More utilities are contracting out line construction projects to established contractors who have the technical know-how, equipment and skilled manpower to supplement the normal work of utility construction divisions. And the increase in street, highway and tollway interchange lighting; relighting of urban business districts; shopping center parking area and recreational area lighting is opening a vast market to all electrical contractors.

While a substantial portion of this work is done by line contractor specialists, more of the so-called "inside contractors" are encountering line work in their normal operations. Some of these contractors sub-contract such work to established specialists with engineering staffs and equipment geared to efficient volume operation. Others, with an eye to future work, have set up a separate department equipped and staffed to handle pole and line construction.

Regardless of how contracts are handled, mechanization is the key to cost-cutting field operations. Proper tools, equipment and trained mechanics must be used. Linemen possess vastly different skills and tools than the conventional "inside" electrician and the two cannot be switched back and forth. Neither can the materials and equipment, generally speaking.

Like underground work, heavy

power equipment combined with carefully planned installation techniques substantially reduces field man-hours. Boom trucks, mobile hole-boring rigs, heavy reel trucks and trailers, and cable tractors are the line contractor's major mechanized equipment items. Today, pole and guy anchor holes are dug in a matter of minutes with power augers; poles are being set with boom trucks using half the crew needed for the hand piking methods. More assembly work is being done on the ground. Transmission towers are being erected in preassembled sections hoisted into position by power booms. On some projects, where tower height exceeds boom height or terrain is exceptionally rough, helicopters are used to transport and set preassembled tower sections; also to speed conductor stringing.

For pole work, cross-arms and as much pole hardware and conductor supporting equipment as possible are installed at ground level before the pole is set. Prime goal is to cut installation time and minimize the amount of aerial work necessary.

Mobile conductor pay-out stations normally are of the reel-truck, trailer or crawler types, depending on the terrain encountered. Tension instruments assure proper conductor tension and sag on long-span installations.

Most recent innovation in high-voltage line construction and maintenance is a field-tested method of working bare-handed on live lines. Linemen stand in fiberglass buckets at the end of an insulated aerial boom; are at the same potential as

BARE HAND live line work is latest technique added to time-saving line operations. Men in fiberglass buckets at end of insulated boom stand on wire mesh bucket linings which are clamped to conductor on which men are working. Men and conductor at same potential, hence no current flow or shock hazard.

JACK-KNIFE BOOM with hydraulic controls has full vertical and horizontal range to elevate personnel to convenient working position. Units have either single or dual buckets as required. Truck outriggers stabilize base.

DUAL-PURPOSE impact wrenches speed line work. With wood auger, they do a fast drilling job on poles and crossarms; with socket attachment, they run bolts and tighten nuts in a matter of seconds.

LINEMAN EQUIPMENT includes sturdy safety belt, sharp climbing spurs, gloves, hard hats and a full complement of hand tools in belt supports and canvas bags.

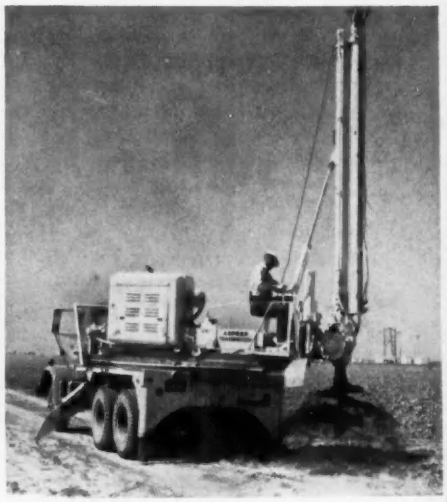
Recommended Pole Setting Depths in Soil and Rock for Various Lengths of Wood Poles

Length of Pole in Ft	Setting Depth in Soil in Ft	Setting Depth in Rock in Ft
20	5	3
25	5	3.5
30	5.5	3.5
35	6	4
40	6	4
45	6.5	4.5
50	7	4.5
55	7	5
60	7.5	5
65	8	6
70	8	6
75	8.5	6
80	9	6.5

Source: Lineman's Handbook, McGraw-Hill Book Co., Inc.

TWO CRANES raise 80-ft, 22,000-lb, pre-stressed concrete pole with complete floodlighting assembly. All floodlights were mounted and preset on ground prior to raising poles.

AERIAL EXTENSION ladder on service truck has counterbalance at base; has 35-ft reach and convenient working platform; can be inclined at any desired angle; retracts for road travel.



SWING-BASE heavy-duty earth-boring machine digs holes for transmission-line poles; also digs at angle for anchor holes; has adjustable boom and winch for setting pole assemblies.

the line because they are standing on a wire-mesh bucket lining which is clamped to the conductor on which they are working. With no potential difference there is no current flow and the linemen work faster, in greater safety, without being hampered by cumbersome "hot line" tools and equipment. This new technique is being used by utility members of the American Electric Power System and may become their standard practice.

Street, highway and parking area lighting involves a combination of methods. With the current trend toward underground distribution, circuit installation will follow techniques outlined in a previous section (Underground Work). Equipment and methods used to set the lighting standards will be much the same as those outlined above. Lighting standards are completely preassembled (bracket arms, luminaires and accessories) and prewired on the ground. Truck booms are used to set the standards and the final connections are made at the base. For this type of work, the swing-type hydraulic boom has become a contractor favorite.

New ideas and refinement of techniques develop with almost each new project. The common goal is increased safety to personnel, better workmanship, reduced installation time and lower over-all costs.

APPROXIMATE LENGTHS OF TIE WIRES

Type of Tie	Conductor Size	Length of Tie Wire
Western Union	3/0 bare cable	54 in.
	2,000,000 CM cable	87 in.
Bridle	4/0 bare cable	54 in.
	2,000,000 CM cable	87 in.
Horseshoe	All sizes	39 in.
Armored Western Union	All sizes	102 in.
Armored Top	All sizes	114 in.
Stirrup	All sizes	Two pieces, each 54 in.

Notes:

Use insulated ties with insulated line conductors; bare ties with bare line conductors; copper ties with copper line conductors; aluminum ties with aluminum line conductors. Tie wires should be made of soft-annealed wire.

Tie Wire Size: No. 6 for line conductors No. 4 and smaller; No. 4 for line conductors No. 1 to No. 4; 2 tie wires for line conductors No. 1/0 and larger.

Source: Lineman's Handbook, McGraw-Hill Book Co., Inc.

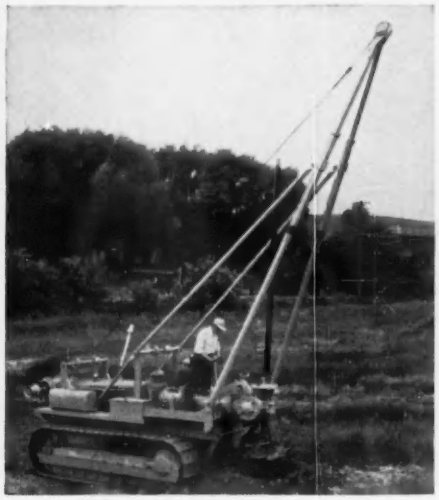
GUYING POLES—Effect of Lead on Tension in Guy and Earth Uplift

(Assuming a horizontal constant force of 1000 lbs)

Height of Guy Ft	Lead of Guy, Ft—Pole Base to Anchor	Load in Guy, Pounds	Uplift in Earth, Pounds
30	5	6180	6000
30	10	3160	3000
30	15	2240	2000
30	20	1800	1500
30	25*	1560*	1200*
30	30*	1410*	1000*
30	35	1320	860

Note: Best loading conditions are indicated with an asterisk.

Source: Lineman's Handbook, McGraw-Hill Book Co., Inc.



VERSATILE CRAWLER tractor combines earth auger, pole-setting boom and power winch in a compact, highly maneuverable unit that works well on level and rough terrain.

CONTRACTOR'S LINE TRUCK has power earth auger as standard equipment. Mechanics have just completed digging hole for highway lighting standard replacement.

ADJUSTABLE BOOM on line-truck auger is used to set completely assembled highway lighting standard. Connections are made at base. One truck and one crew does complete replacement job.

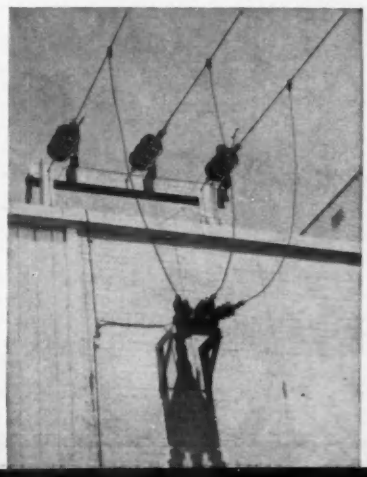
AERIAL PLATFORM at end of telescopic hydraulic boom raises mechanics and lighting fixture into installation position. Remote control on safety rail permits men to maneuver boom and platform at will.

HYDRAULIC BOOM on contractor's truck has telescoping member to raise, position and hold lighting standard while crew bolts it to pre-installed base. Personnel platform can be added to boom.

TREE TRIMMING can be done much faster when men have sure footing on sturdy boom platform. Street lighting contractor used versatile boom truck to clear space for lighting standards.

TWIN-LEVEL tool, with adjustments for pole taper, permits quick check of lighting standard alignment while base bolts are being tightened. One man can check vertical alignment in two planes simultaneously with this simple unit. Tool was developed by contractor to speed street lighting work.

DEAD END for high-voltage line serving industrial plant. Bracketed steel structure on roof supports insulators; smaller bracket on wall supports service pothead.



TOOL AND EQUIPMENT INVENTORY

Tools --A normal complement of tools (see preceding section lists) for type of wiring at hand

Equipment

Portable generators--gasoline driven
Temporary service equipment--meter, disconnects, etc.
Receptacle centers--fuse or circuit breaker protected, 3-wire grounding type, twist-tight type receptacles and plugs
Pigtail sockets for lighting
Long extension cords--3-wire, grounding type
Wire and cable--feeders and branches

TEMPORARY POWER FACILITIES

TEMPORARY power facilities are a prerequisite to the use of efficient, cost-cutting job tooling on construction projects. Unless a well-designed temporary power system is available to installation crews, anticipated savings of mechanized techniques may diminish and labor costs rise. The vast array of power tools used by electrical contractors were listed in previous pages. Other trades have a similar list pertinent to their own specific operations.

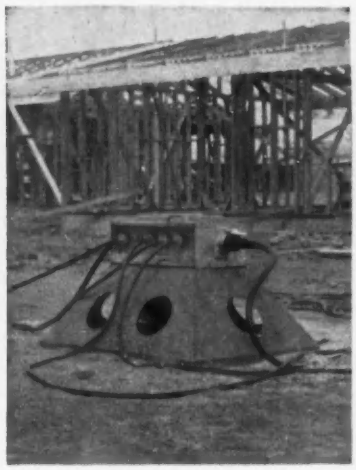
The electrical contractor is generally responsible for providing adequate temporary power service (utility or portable generator), distribution and branch-circuit facilities for use of all trades. Unless definite temporary power specifications are available (and they seldom are), he must estimate all requirements and design and install the system accordingly. Frequently, large power equipment such as electric welders and material hoist motors might be encountered. Provision should be made to handle such loads.

Where utility lines are within reasonable distance, temporary service equipment can be installed. Where this is not possible, gasoline-driven, portable generators can be used until a permanent power line is brought to the property line. It is considered good practice to have both 115-volt and 230-volt power available for temporary use. Sometimes portable generators are kept on a project as a spare source of limited power should regular service fail, or for limited use in remote points where extension of temporary power circuits would be impractical. All these factors must be carefully evaluated in the estimating stage so adequate provisions can be included.

Methods of installing temporary power systems vary with contractor and project. Standard practice is to string open wiring around a

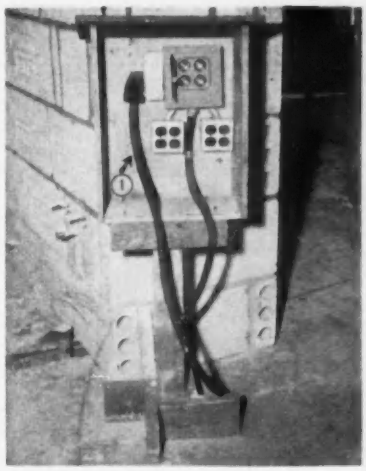
MOBILE SUBSTATION provided large blocks of temporary power at utilization voltage to construction site until permanent transformer was installed. Utility also uses unit for emergency purposes.

MOBILE GENERATORS on trailer mounts provide 25 kw, each, of 110/220-volt temporary power for construction trades. Each unit has four heavy-duty cables supplying four sub-distribution centers for branch circuits.



RAINTIGHT SUB-PANELS on flared steel pedestals, fed by portable-generator cables (end), have 110-volt receptacles on one side and 220-volt outlets on the other; also driven ground.

RESIDENTIAL SERVICE equipment on temporary support was first item installed and connected to underground service; provided electric power for construction tools used to build house around service. Technique used on a 6,000-home project.



PLUG-IN PEDESTAL has four fused-protected, 3-wire duplex receptacles for power tools on floor area; is fed by 50-amp range cable and plug from floor below; has plug-in feeder (1) for pedestal on floor above.

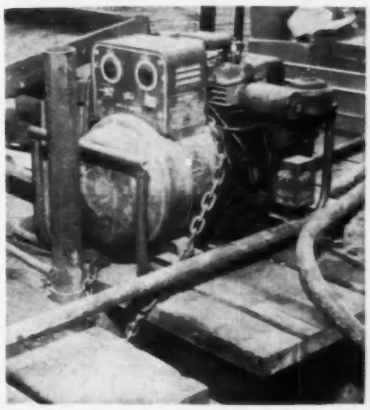
structure for feeders. On multi-story buildings, some contractors pull temporary feeders in spare riser conduits and tap off to branch circuit "posts" or "pedestals" at pull-box openings on various floors. Others use "power pedestals" at each floor with plug-in feeders (range cable or heavy-duty cords and receptacles) between pedestals.

Pigtail sockets are still being used extensively for temporary lighting circuits. For safety reasons, pigtails are no longer used for power tools. Current practice is to set up 3-wire, grounded receptacle centers with individual receptacles protected by branch-circuit breakers or fuses. The entire temporary power system should be well grounded to eliminate possible shock hazard. Most contractors prefer the twist-tight type of receptacle and plug to prevent inadvertent disconnection of extension cords.

Regardless of system used, all temporary power distribution facilities should meet two important conditions. First, the service (utility or portable generators) should be large enough to handle the anticipated loads. Second, all conductors—feeders, branch circuits and long extension cords—must be of sufficient size to eliminate excessive voltage drop. (See Chart—Size of Extension Cable for Portable Electric Tools—Fastenings and Supports Section.)

SMALL PORTABLE gasoline-driven generators are standard equipment item with most electrical contractors; provide on-site temporary power for installation tools; can be moved quickly from site to site.

TEMPORARY SERVICE MAST on contractor's trailer can be detached and loaded inside; provides power for lighting and shop tools in trailer, plus power outlets on underside for outdoor bench assembly work.



FIELD FABRICATION of electrical system components is accelerated by portable generator powering trailer-mounted conduit threading and cutting machine plus array of hand power tools. 110-volt and 220-volt power are available.

TOOL INVENTORY

Benches, work, stationary, rolling
Benders, conduit, tubing, bus--mechanical, hydraulic manual or power
Block and tackle
Boxes, tool and material storage--stationary or rolling
Bullpoints
Burners, gas, acetylene
Cable pullers
Cable jumpers--to maintain service during alterations
Cutters, cable, conduit, tubing, knockout--manual, power
Cut-off shears, angle and flat steel stone, surface raceway, etc.
Compressors, air
Cords, extension
Dollies
Drills, electric, impact, pneumatic
Drills, wood, steel, concrete
Drivers, stud, powder actuated
Electric welder, stud
Goggles, safety
Gloves, safety
Hammers, manual, electric, pneumatic
Indenter tools, tubing connector
Labels & tags--conductor, raceway
Ladders, A, step, rigid, extension, mobile
Lug tools, cable, wire--mechanical, hydraulic
Platforms, extension, lift, hydraulic
Reel carts
Saws, wood, concrete, metal and hole cutting
Screw drivers, hand, ratchet
Screws and bolts, assortment
Scaffolds, adjustable, rigid, rolling, stationary, sectional, telescopic
Stock, bolt, angle, channel, continuous channel framing, slotted angle
Threaders, conduit, bolt, hand, power
Towers, rolling, hydraulic lift type with platform
Torches
Welding equipment
Winches
Wrenches, assortment suitable for work at hand

Note: Choice of tools for alteration work depends upon the type of electrical construction involved: conduit, underground or overhead, line work, etc. For additional tools in these categories see tool inventory lists in other sections.

1962 TOOLS AND METHODS ●

ALTERATION WORK

ALTERATION work, as applied in this discussion, covers all electrical work done in existing structures, whether the project be complete rewiring, system rehabilitation, or merely additions to or extensions of existing circuits. Regardless of scope, work of this type seldom, if ever, is as clear cut as new construction. Existing structural and job conditions, stringent space limitations, and working without disrupting normal plant production or disturbing building tenants are problems an electrical contractor must face and solve.

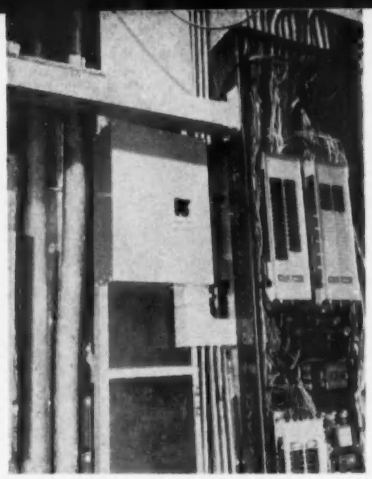
This is one area of construction where the field-engineering talents, installation know-how and construction experience of the electrical contractor are key factors in cost-control. In fact, close cooperation between contractor, engineer and owner with respect to routing of circuits, placement of equipment and working facilities is almost a prerequisite to reasonable installation economy.

From the electrical contractor's standpoint, alteration work can be simple or complicated, profitable or unprofitable, almost in a direct relation to the way the project is organized, equipped and handled. Power tooling and modern installation methods are his biggest weapons in the constant battle to control installation man-hours. The better equipped firms usually show the better profits while improving their place in the competitive field.

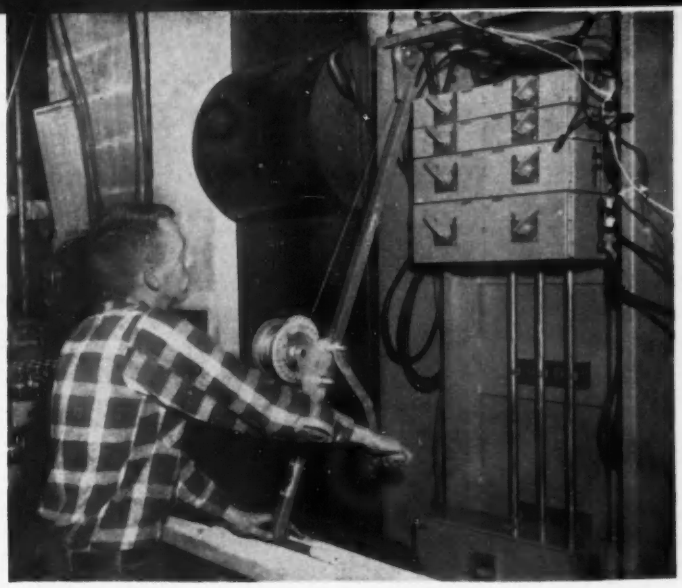
Unlike new construction, where sleeves and inserts can be installed during construction, most alteration projects involve a substantial amount of drilling, cutting and patching, especially on multistory reinforced concrete structures This is one era in which modern power tools can slash drilling time from hours to minutes.

Progressive design improvements and refinements in concrete and masonry drilling equipment have transformed hole cutting to a "snap" field operation. Diamond bits and core drills have been known to cut through reinforced concrete at a rate of 1 to 3 in. per minute, depending upon aggregate and amount of steel rod encountered. Typical example: An electrical contractor, using diamond drill equipment, cut a 5-in. dia. hole through 35 in. of reinforced concrete in 35 minutes actual drilling time. Rig setup, adding drill extensions and removing core sections ran the total time per hole up to 120 minutes.

Total time per opening varies with the number and location of holes, type of masonry and facili-



PRECISE FIELD engineering and careful equipment selection by contractor simplified installation of high-ampere busway feeders and new distribution panels in existing electric closets for hotel rewiring project. Resultant man-hour savings were substantial.



PORTABLE HAND cable puller with two-speed winch arrangement makes conductor installation a one-man pulling operation. Power units are used for larger cables.

SLIM DESIGN of combination electric drill and impact tool permits "close-in" drilling of holes in masonry, wood or steel. Simple knob controls impact mechanism.

ELECTRIC HAMMER with a complement of cutting accessories is a handy tool for alteration work. Here, mechanic drills hole in ceiling for equipment support.

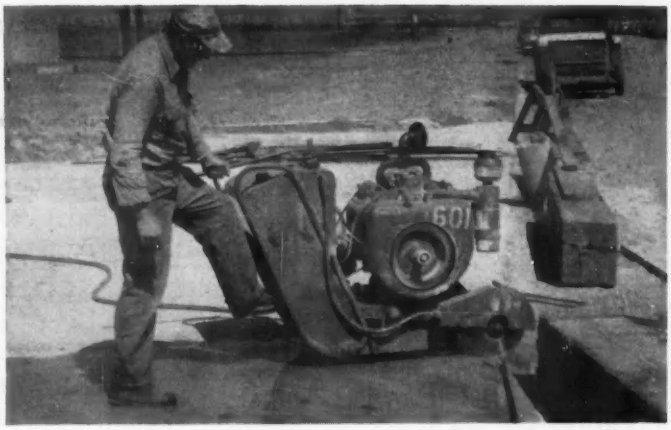
LIGHTWEIGHT portable hydraulic conduit benders can be carried up ladders with ease; permit time-saving overhead bending of in-place conduits when necessary.

ELECTRIC JIG SAW with plunge-cutting feature makes pocket openings for outlet boxes in single operation; eliminates drilling corner holes; is a handy tool for alteration work.

RECOMMENDED SPEEDS AND PRESSURES FOR DRILLING CONCRETE WITH CORE DRILLS

Drill Size in Inches	Electric Drill Size	Drill Speed in RPM	Suggested Applied Pressure in Pounds
¼" to 7/16"	¼" or ½" light, medium or heavy duty	500 to 750	50 to 200
½" to 13/16"	½" light, medium or heavy duty	300 to 500	150 to 500
⅞" to 1⅞"	½" or ¾" medium or heavy duty	200 to 500	250 to 700
2" to 2¼"	¾" heavy duty	100 to 300	300 to 800
2½" to 4½"	1" or 1¼" heavy duty or equivalent rotary air motor	100 to 300	300 to 800
4¾" to 6"	2" rotary air motor or equivalent	60 to 125	750 to 2000

Note: If possible, apply pressure with lever or jack mechanism.
Source: Tilden Tool Manufacturing Co.



CONCRETE SAW, with adjustable depth control and cutting-edge water spray, channels slabs in minutes; can be powered either by gasoline or electric motor.

SIMPLE CONTROL BOARD is one way to keep tabs on job tools. As requisitioned tools are dispatched from shop, identification tags are placed on proper hook under job or foreman's number, whichever method is preferred.

ONE-SHOT HYDRAULIC punch simplifies in-place cutting of overhead pullbox openings to match conduit entries.

ties for anchoring the drill rig. The addition of vacuum suction pads to drill stands cuts anchoring time.

For the smaller drilling jobs, contractors use a variety of electric drills, hammers and impact tools with either manual or automatic rotation of cutting tool. All are effective time savers. Latest addition to this category is a single drill that combines high-speed drill rotation with knob-controlled high-frequency impact strokes. With standard carbide-tipped, spiral drills, the tool reportedly can cut up to ⅝-in. dia holes at cutting speeds ranging from 2½ to 10 in. per minute, depending on type of masonry drilled. Correspondingly slower speeds are reported for larger holes. For drilling in wood or steel, a turn of a knob disengages the impact mechanism and provides rotation only.

Concrete saws cut floor slabs in a jiffy; dual-cutter electric plaster groovers, with vacuum cleaner attachments, now channel plaster walls and ceilings in a quick, clean, efficient manner.

Lightweight hydraulic bending equipment can now be carried up a ladder for overhead offsets on in-place conduits. Hydraulic knockout punches can make openings in overhead pullboxes in a matter of seconds. And portable power threaders can thread in-place conduit raceways.

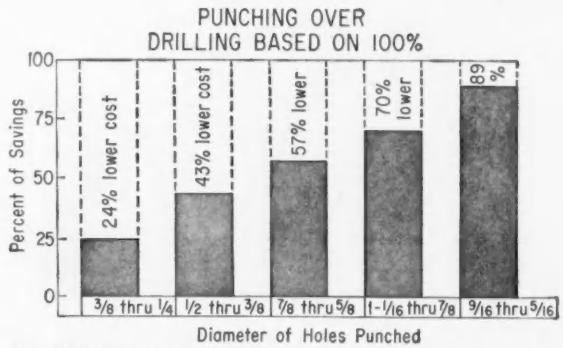
While the techniques cited include some of the more dramatic time-saving field operations, practically every tool and method mentioned in previous sections may be used in alteration work. Choice of tools is governed by the specific work to be done and the job conditions encountered.

RECOMMENDED SPEEDS FOR DIAMOND DRILLS

Electric Motor Drill Speed—RPM	Optimum Bit Size Dia—In.	Air Motor Drill Speed—RPM
350	5–6	350
500	4–5	500
750	2–4	725
1000	1–3	1025
	1–2	1500

Note: Water swivel attachment provides water necessary for efficient drill operation.

Source: E. J. Longyear Co.



Source: W.A. Whitney Mfg. Co., Rockford, Ill.

PERCENT SAVINGS recorded by using portable punching equipment over drilling on mild steel. Savings increase with hole size.

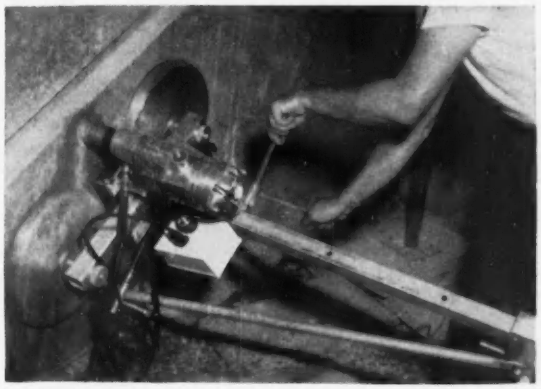
MOBILE DRILL RIG is highly maneuverable; gets in tight quarters; permits drilling in any direction (see inset); has telescoping jack-screw ceiling support; precision drill feed; water collector unit. Diamond drills cut concrete at rates of 1 in. to 30 in. per minute.

SMALL HOLES can be cut quickly with hand drill. This unit features built-in water swivel and control valve for diamond bit drilling in concrete and masonry construction.

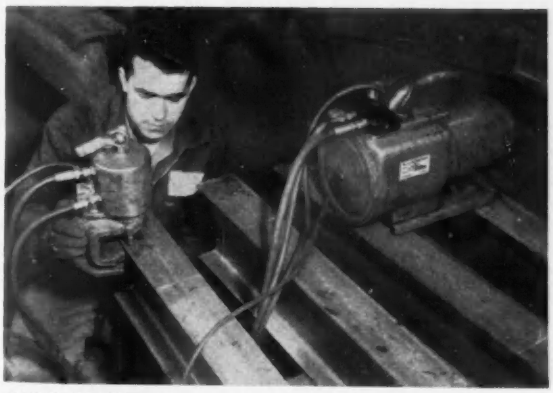
DRILL CART is standard equipment for a commercial building electrical department; contains water tank, circuit wiring, tank vacuum and mobile drill rig with vacuum pad base (also vacuum pump) for rigid positioning. Unit is used to cut into cellular concrete floor.

Although tooling and mechanization account for a good percentage of time saved in the field, contractor know-how and installation engineering have a very definite impact on over-all project efficiency. Electrical systems for alteration projects must be tailored to fit building and structural design. Carefully selected equipment components and pullbox or cable trough designs can often reduce a complicated raceway problem to a simple installation.

Generally speaking, the cost-control formula embraces a combination of proper tooling, installation techniques, equipment selection, and contractor ingenuity.



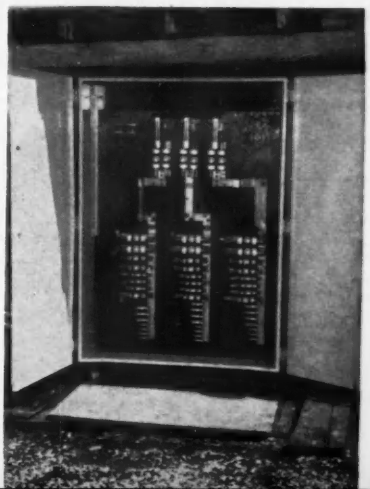
VACUUM PADS hold drill rig securely to wall for horizontal drilling; substantially cut drill setup time. Suction is provided by separate vacuum pump available with units.



ONLY SECONDS are required to punch holes in 8-in. steel I-beam with 20-ton, C-frame, portable hydraulic punch. Actual punching time for $\frac{9}{16}$-in. hole was four to five seconds.

IN-PLACE THREADING of conduit with portable power threader frequently permits use of existing conduit for rewiring circuit extensions.

MOBILE DISTRIBUTION panels, like this cabinet on casters, save contractors valuable time in maintaining essential electrical service on changeover or alteration work. Cabinet rolls onto truck and in place at job site.



EQUIPMENT INVENTORY

Motor scooters, electric carts, bicycles
Intercom systems--job site
Radio--mobile, 2-way
Radio--portable, 2-way for job site use
Telephone--conventional, sound-powered
Trucks--small, for on-the-job use

1962 TOOLS AND METHODS ●

JOB COMMUNICATION

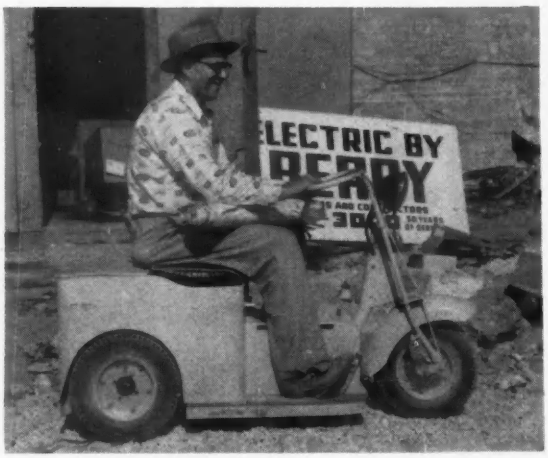
JOB communication is an area in which the electrical contractor can do much to improve specific job coordination and upgrade the efficiency of his over-all business operation. With progressive increases in wage rates, time has indeed become a substantial monetary item for the contractor. Delays in relaying field instructions, change orders, or dispatching men and materials can be very costly. Such conditions are particularly unfortunate if they are caused by poor or inadequate lines of communication, because equipment is available to prevent this.

The mobility, speed and efficiency evident in current installation techniques are also found in present job communication practices. Key men on modern sprawling building and construction projects save time by making their inspection rounds and emergency trips on motor scooters, electric trucks or small job-site trucks. Field intercom, telephone and portable 2-way radio provide instant voice communication between field office and installation crews. Technical or field problems can be answered in a jiffy; or if the "boss" is needed at the installation site, he can be reached by one of the above methods. And the use of two-way mobile radio has eliminated a lot of dead mileage formerly rolled up between contractor headquarters and various construction projects.

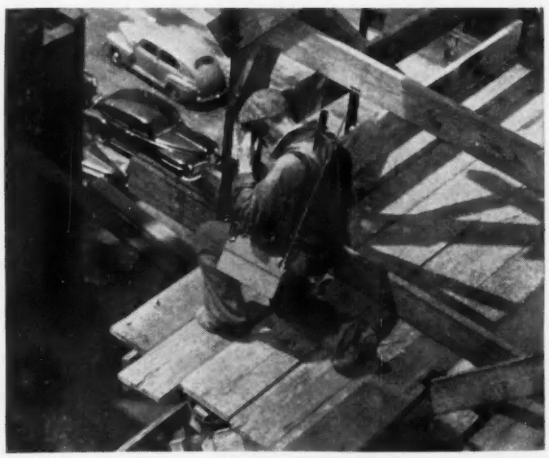
Two-way mobile radio has been used by contractors for a number of years, primarily as communication between home office and roving truck crews or supervisors. Licensing was under the Federal Communications Commission's Citizens Band Service and equipment was generally limited to the mobile (truck) type.

Some contractors, licensed under the Low Power Industrial service, have been using two-way radio for on-the-job communications using portable "walkie-talkie" type equipment. However, transmitter power output for the LPI system is restricted to 3 watts, barely adequate to cover a reasonable construction area.

In 1959, FCC licensing changes liberalized the use of two-way radio so any legitimate business can take

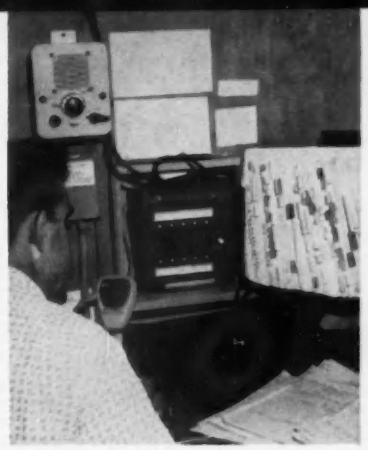


MOTOR SCOOTER saves valuable time for electrical superintendent making his inspection rounds on a sprawling shopping center project. Electric carts and bicycles also are used to cut leg-weary hiking.



WALKIE-TALKIE radiophone is big time saver on high-rise construction project. Here, mechanic on upper floor gets answer from superintendent at ground level and is back to work in minutes.

TWO-WAY RADIO in truck permits supervisor to request rush material delivery from headquarters for one job; and to coordinate work on another project miles away—all in a few minutes. Radio saves his time and that of job crews.



CONTRACTOR'S DISPATCHER contacts service truck on road to give rush order. Two-way radio cuts non-productive time and "dead" mileage through direct routing of service trucks.

full advantage of its benefits. At that time, the FCC established the Business Radio Service which provided a great number of channels with frequencies available in all areas of the land mobile spectrum. Low and high power equipment can be used and licensing is relatively simple.

The BRS system is ideal for the electrical contractor. He can put a base station in his company headquarters, mobile units in his trucks and supervisors' cars, and portable two-way units on the construction sites. With it, he could provide instant communication between all persons—office, trucks and job site.

Recent developments in the mobile radio field include new circuitry that suppresses ignition noise interference. This improvement extends the effective range of the equipment and improves clarity of message reception, particularly in heavy traffic areas. And the introduction of an economical transistorized mobile radio brings this form of communication within the range of the smaller contractor whose sphere of operations is within normal communication range requirements.

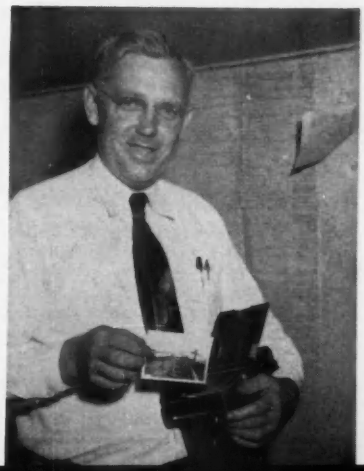
Current observations indicate, and equipment manufacturers agree, that more electrical contractors are using time-saving communication equipment to improve their job coordination. This applies to home office as well as field operation. The net result is a consistent reduction of "wasted" manhours and a more productive assignment of supervisory time that definitely upgrades operating efficiency.

BATTERY-POWERED TELEPHONE links winch operator with mechanic at reel setup; permits instant instructions to coordinate pulling and feed-in operations on long cable pull.

SOUND-POWERED TELEPHONE is used by electrician checking relay operation to immediately report findings to associate at central control board 14 floors below. Portable unit is self-powered.

LIGHTWEIGHT two-way portable radio equipment with clip-on belt receiver and small transmitter has limited range but works extremely well on small construction projects.

RAPID VISUAL communication for distant headquarters use. Polaroid cameras, featuring 10-second prints, can chronicle installation problems, structural conditions and general job progress.

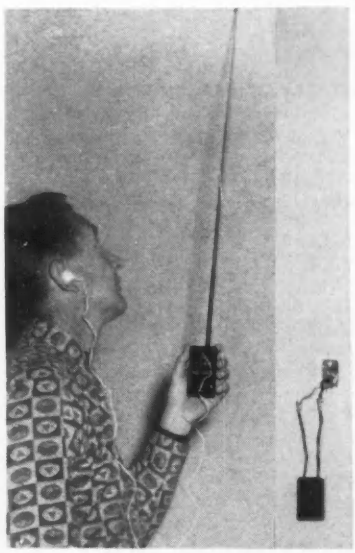


TOOL INVENTORY

Portable Instruments and Equipment

- Ammeters
- Circuit analyzers
- Continuity testers
- Demand meters
- Fluorescent unit testers
- Footcandle meters
- Frequency meters
- Graphic meters—various types
- Ground detectors and locators
- Ground resistance testers
- High potential testing units
- Identification tags, labels
- Insulation testers
- Ohmmeters
- Oscillographs
- Phase sequence indicators
- Power factor meters
- Tachometers
- Transformer oil testers
- Voltage testers
- Stroboscopes
- Wattmeters
- Blowers and vacuum cleaners
- Communication equipment—see list in previous section. Personnel radio paging system —used in buildings with built-in loop antennae
- Fixture washing equipment
- Maintenance control boards—for supervisors' office
- Record equipment—data file cards for feeders, branch circuits, transformers, switchgear, panels, controls, motors, etc
- Scaffolds and ladders—see list in previous section
- Tools—see lists in previous sections for applicable items

TOOLS FOR MAINTENANCE



COMPACT TRANSISTORIZED fault finder locates breaks in electric ceiling heating cable; spots covered outlets, boxes and concealed wiring. Signal generator is clipped to embedded cable leads. Earphone of receiver pack, with telescoping antenna probe, picks up amplified signal as operator scans area.

RADIO PAGER on mechanic's belt (arrow) provides instant one-way communication with building electricians. Building has inside loop antenna for system operation.

EFFICIENT operation of electrical systems and associated equipment is a function of three basic factors: (1) good original design; (2) proper installation; and (3) effective maintenance. The prime objective of all three is to keep an electrical installation operating in a trouble-free state at designed efficiency levels. Maintenance ease and economy will depend, to a considerable degree, on how well the first two factors—design and installation—are executed.

Such simple maintenance aids as color-coded conductors, tagged or labeled circuits, identified switches, breakers and controls, can—and should—be included in the design and installation specifications. If not, such identification should be accomplished as soon as a system is put in operation, for this provides the basic "road map" for tracing trouble when it occurs.

True maintenance involves established procedures to ferret out system weak spots and take remedial measures before an actual break-

down occurs. Some electrical system components demand more frequent attention than others. For example: oil transformers, circuit breakers, switches, contacts, motors, lamps and lighting accessories, relays and other moving parts subjected to electrical or physical wear are more apt to cause trouble than conductors and similar components.

All parts of a system should be checked periodically to detect and assess any abnormal component deterioration in time to make necessary corrections before an actual breakdown causes a costly production shutdown. Such a program is termed Preventive Maintenance and is the key to efficient plant operation.

A well-organized, well-executed maintenance program represents a substantial investment in trained personnel, records, test equipment and repair facilities. However, when compared to possible production and equipment losses, preventive maintenance is low-cost insurance against expensive, unexpected plant shutdowns. Field experience has proved this repeatedly.

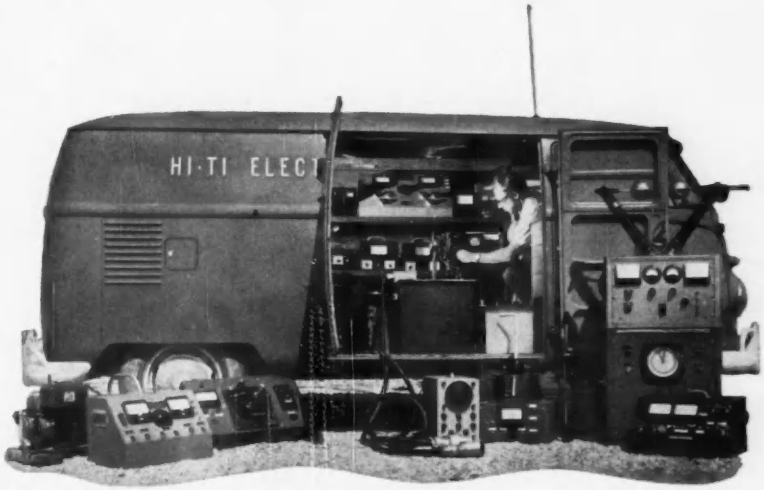
Economic factors determine whether a plant (or building) does its own electrical maintenance or "buys" this service from an outside specialist. Plant departments, like contractors, must sell a maintenance program on the basis of tangible returns on management's investment.

Most of the larger plants and commercial buildings maintain their own electrical maintenance departments. Some have found it more economical to "contract out" all or part of this work. Others are viewing this latter approach with cautious interest. Some limit contract maintenance to high-voltage equipment and system components. And there are firms with a complete array of instruments, test equipment and technical personnel to provide such service within specific geographical areas.

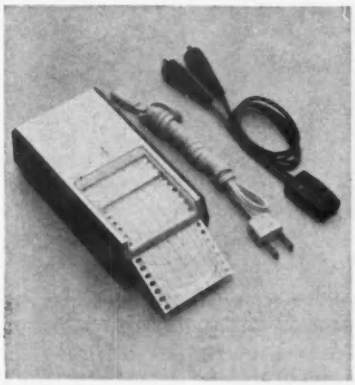
Although the swing to "outside" electrical maintenance is somewhat gradual at present, there is a definite trend in that direction. The future will probably see more plants take advantage of this type of contractor service.

Perhaps the most significant shift to "contract maintenance" is in the lighting field. Normal lamp depreciation can reduce lumen output of a lighting system as much as

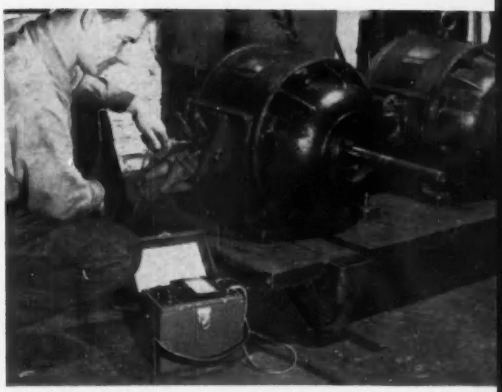
PORTABLE INSTRUMENTS are the electrical maintenance man's diagnostic "tools" for quick, accurate check and analysis of electrical trouble to establish proper remedial measures. Periodic checkups can uncover weak spots that might cause serious system breakdowns.



MOBILE TEST FACILITIES and technical personnel are offered by an electrical firm specializing in high-voltage testing and cable fault location. Radio-dispatched vans, like this, carry array of instruments and equipment for field-testing in three-state operating area.

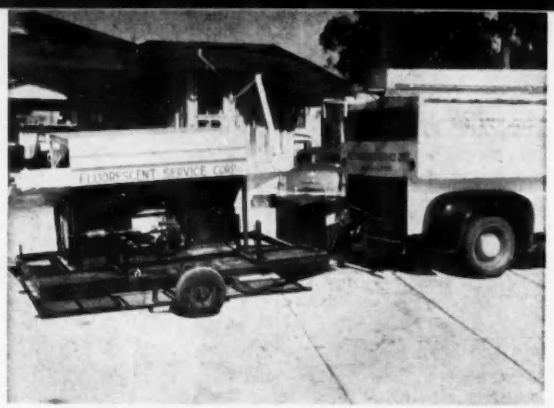


ANOTHER DIAGNOSTIC tool is a miniaturized precision recording instrument that makes a permanent record of variable voltage, current, watts, etc. Without paper tape, unit can be used as an indicating meter.

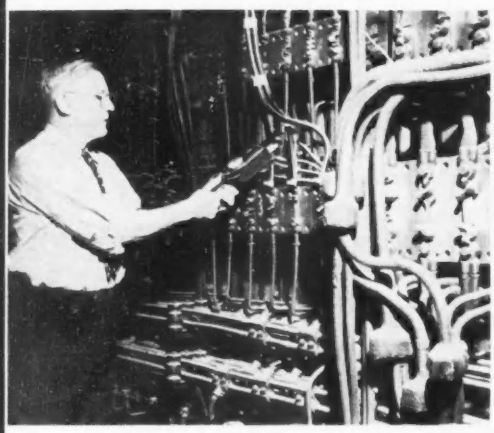


DUAL PURPOSE instrument is being used here to check voltage across motor terminals. With a flick of a selector switch, same unit can be used to check insulation resistance of windings.

SERVICE TRUCKS of a lighting maintenance contractor carry ladders on top, meters, ballasts, lamps and other components in interior bins.

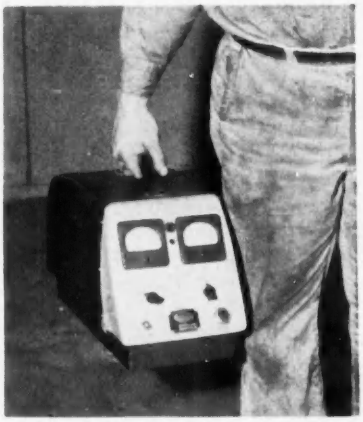


MECHANIZED CLEANING of fixtures has become standard procedure with lighting maintenance contractors. Washers, like this trailer unit, cut cleaning time and do a better job.



CLAMP-ON METER is a handy instrument for quickly checking feeder and circuit loads. Periodic checks can spot possible trouble sources.

FOR OVERLOAD RELAYS on motor starters, instrument like this checks tripping characteristics. Unit also can be used to check pick-up, reset and time-current characteristics of low-voltage circuit breakers.



PORTABLE ELECTRONIC vibration analyzer is handy, compact instrument for field-checking rotating equipment under actual operating conditions to spot causes of vibration and unbalance. Unit has plug-in seismic pickup and strobe lamp.

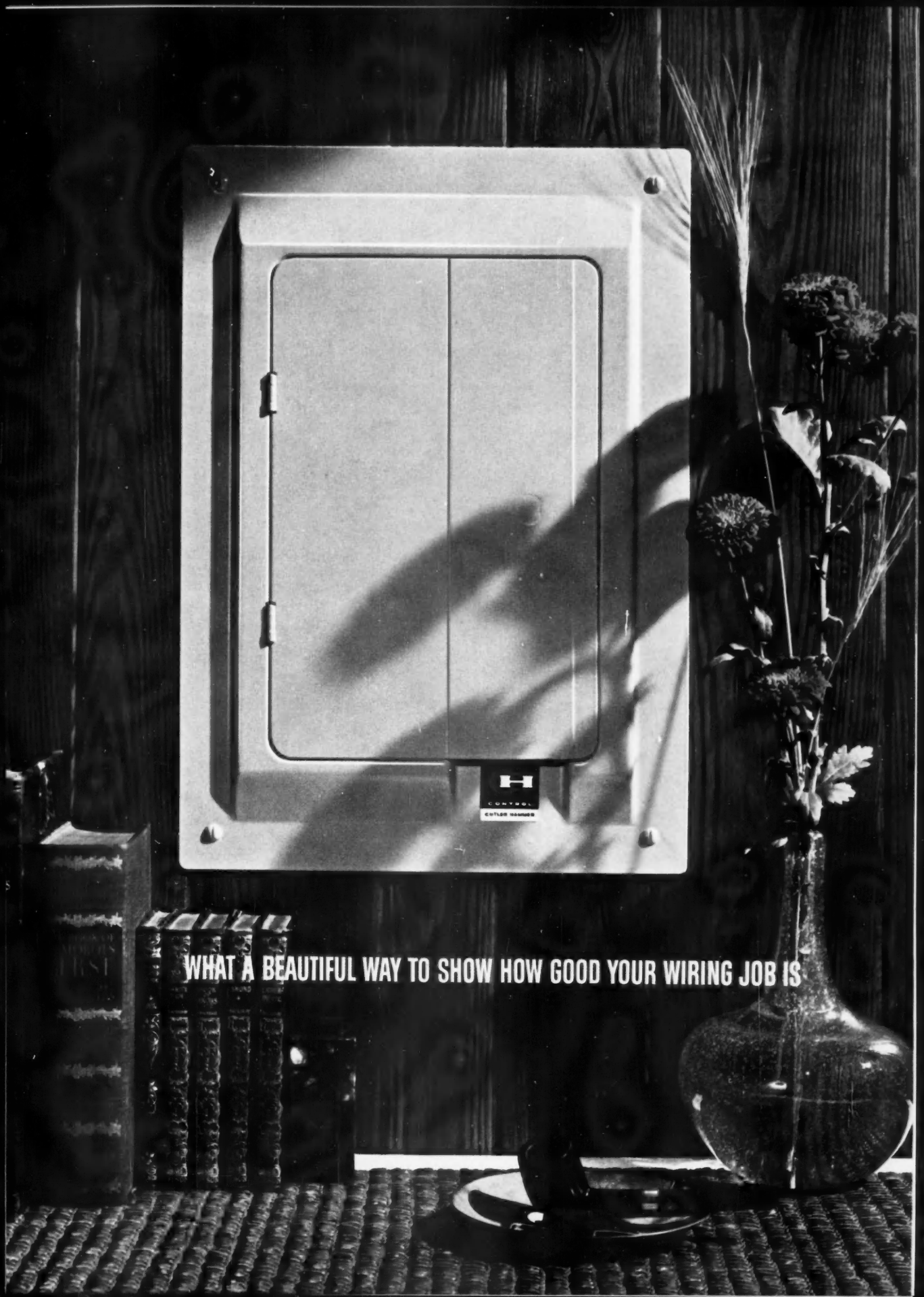
30%; accumulated dust and dirt can cut light output from 20% to 30%; low voltage can cause up to 20% light loss; and some plants lacking adequate maintenance have experienced up to 12% light loss due to lamp burnouts. Management is overcoming these deficiencies and maintaining production efficiency by subscribing to a realistic lighting maintenance program including group replacement (at about 80% rated lamp life) of lamps.

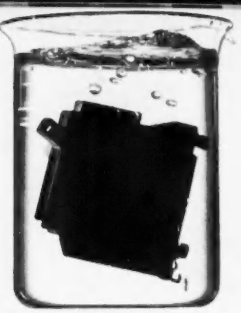
Many plant and building owners have turned these problems over to specialized lighting maintenance contractors who have the equipment (much of it self-designed), personnel and techniques to do a complete job. On a regular scheduled basis, these firms check the lighting system, wash luminaires, furnish and install lamps, replace ballasts and make the necessary miscellaneous repairs to guarantee the specified illumination levels. Monthly service fees depend on the number and type of fixtures, installation environment (affecting frequency of washing, etc.), and the amount of work necessary to maintain desired footcandle intensities. Full responsibility is in the lap of the contractor. Management's only concern is to pay the bill.

Whether a plant crew or an outside firm does the electrical maintenance work, trained personnel, experience, know-how, adequate equipment and proper "tools" are prerequisites to an efficient program. Instruments and established test procedures are necessary to diagnose the existing condition of system components. Adequate records are needed to compare test results, establish inspection schedules, chart deterioration and determine when repairs should be made.

In addition to a normal complement of instruments for test purposes, maintenance personnel must be provided with the proper materials and tools to do an effective job. Many of the tools listed in previous sections can be used for maintenance chores. Selection varies with the work involved. Particularly adaptable are the variety of scaffolds, ladders and aerial equipment for overhead work; also transportation and voice communication equipment available to minimize backtracking and time-consuming searching for and relaying of instructions to maintenance personnel throughout all parts of a building or plant.

Maintenance tools and methods are many and varied; some are illustrated in the attendant photographs. Whatever combinations may be developed to fit specific conditions, the ultimate goal is the same: to provide the most effective and economical program to keep electrical systems and equipment operating at maximum efficiency.


WHAT A BEAUTIFUL WAY TO SHOW HOW GOOD YOUR WIRING JOB IS



WON'T RUST, WON'T CORRODE. Every operating part is either stainless steel or heavily plated for rust and corrosion resistance.

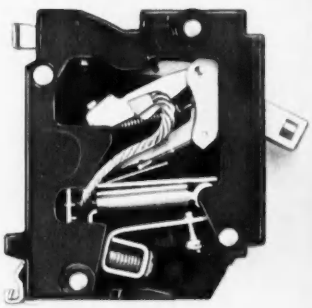
Looks so much better, installs so much easier . . .

Cutler-Hammer's NEW Safetybreaker*

. . . far ahead in every way

Here's a bonus in beauty and protection that gives you—and your homeowner customer—many exclusive features at *no extra cost.*

Why install the old-fashioned "basement gray" box when this modern appliance styling is available for the same—often lower—price?



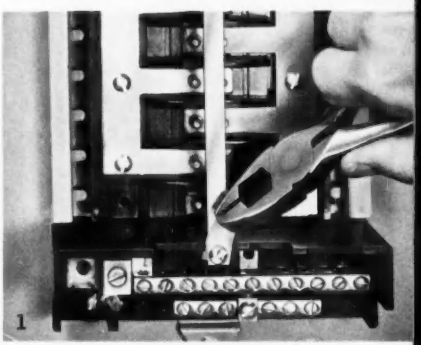
DOUBLE PROTECTION. Both magnetic trip for short circuits and a bimetal trip for sustained overloads.

Simplest, most foolproof non-interchangeability system by far

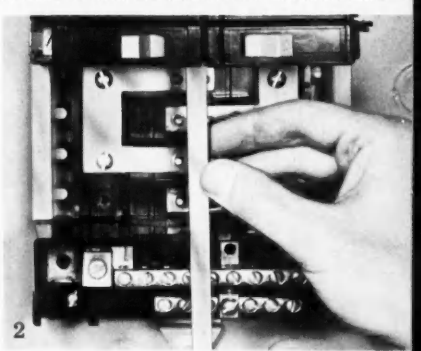
Safetybreaker's simplified non-interchangeability is as far ahead of competition as its styling. There's no fussy keying system. No special tools or "can openers" are required. It's impossible to break off or incorrectly position tabs. See your Cutler-Hammer distributor for a 60-second demonstration. Try it. Prove to yourself how much better, how much easier to install the Safetybreaker is.

Here's how the simple "up-down" N. I. system works:

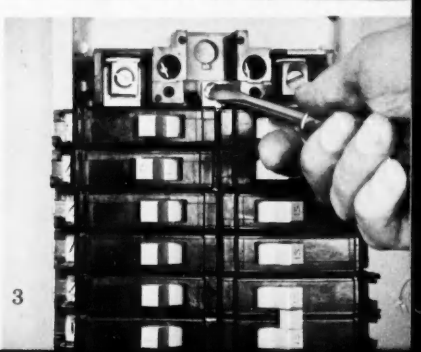
1. Tear off plastic spacers to loosen locking bar screws, and let locking bar drop.
2. Plug in breakers in top portion of panel. Slide bar to top of panel.
3. Plug in remaining breakers. Tighten two special screws to lock the N. I. system. That's all there is to it!



1



2



3

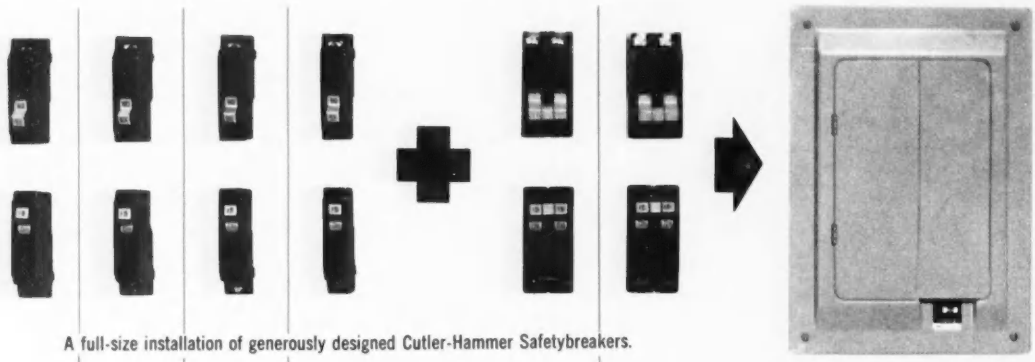
CONTROL

CUTLER-HAMMER

*Cutler-Hammer Trademark

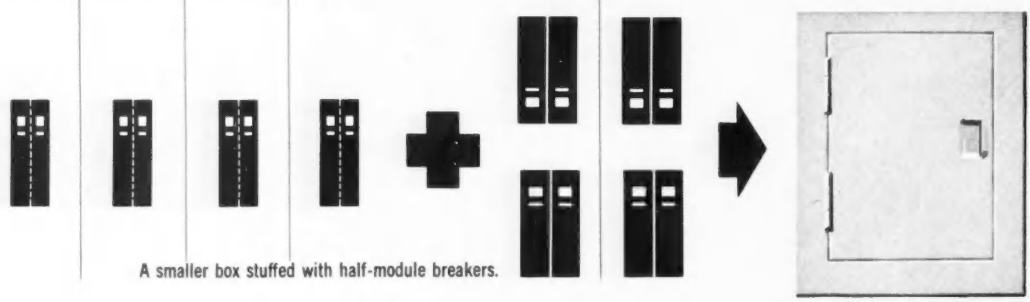
CONTROL
CUTLER HAMMER

CUTLER-HAMMER'S FULL SIZE SAFETYBREAKER IS COMPETITIVE WITH "MIDGET" BREAKERS



A full-size installation of generously designed Cutler-Hammer Safetybreakers.

$70.30 LIST



A smaller box stuffed with half-module breakers.

$70.30 LIST

GREATER VALUE FOR THE MONEY

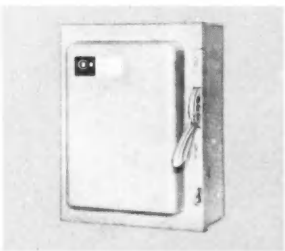
Contractors who use SAFETYBREAKERS know that:

they can provide their customers with FULL SIZE SAFETY-BREAKER protection and value for no more . . . often less, than other contractors pay for half-size installations.

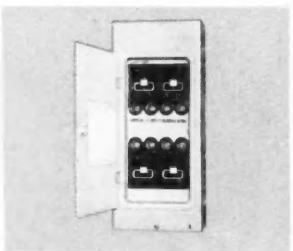
Cost aside, it's a fact that more and more electrical inspectors are insisting upon the use of only FULL SIZE circuit breakers. Their reason . . . FULL SIZE SAFETY-BREAKERS don't offer an opportunity to violate local and national safety codes. Several cities have already outlawed half-size breakers and the number is growing.

Take another look at the actual example illustrated above. Then take a look at the handsome styling, the superior ease of installation, the advanced protection you get with Cutler-Hammer Safety-breakers. The man to see is your Cutler-Hammer distributor.

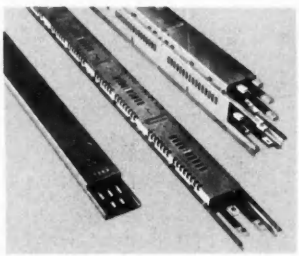
For top performance... these other Cutler-Hammer products



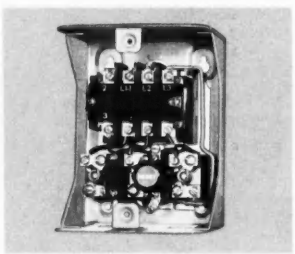
Safety Switches



Fusible Entrance Equipment



A complete line of bus-duct



General purpose motor control

WHAT'S NEW AND BETTER? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus., Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.: Cutler-Hammer, Mexicana, S.A.

CONTROL

ACCURACY AND QUALITY of workmanship improved while product rejection and reworking decreased 32% after this machine plant installed a lighting system which provides average intensity of 200-fc on working areas.

Lighting Benefits Measured by Audits

Benefits of good lighting often are referred to as intangibles; generally admitted but difficult to evaluate in percentages or dollars. Therefore it is always gratifying to receive factual data, such as that recently submitted by an executive of a western industrial plant, proving that footcandles have a measurable production value.

This testimonial comes from Jerry Schoen, president of Metwood Manufacturing, Gardena, Calif., who states that "the year after we relighted, lost-time accidents were off 52% and employee turnover was down 58%. These figures are most commendable and, even if other major benefits had not accrued, these results would have more than justified our investment in a new lighting system."

However, other major benefits did accompany the new lighting. For example, based on a series of 20-day audits taken (1) a month before the new 200-footcandle lighting system was installed, (2) two months after, and (3) a year later, this company reported that machine time efficiency increased 16%, while product rejection and reworking decreased 32%.

Including a new 400-amp service, the total cost of this system approximated $10,000. And, including charges for power, taxes, depreciation, group relamping and maintenance cleaning, the cost of operation is estimated to be about 54 cents an hour.

In evaluating these costs, management considered their 3-shift continuous operation, increased business, payroll, number of employees, cost of product in relation to sales and profit, also the cost of equipment being operated in the relighted space.

Taking these various factors into consideration, Metwood estimates that the relighting of their industrial area amortized itself from values received in 14 months. And, based on these surveys, this same 200-fc illumination level has since been established in office sections.

Infrared Heat Warms Outdoor Service Center

Breuner's department store in Sacramento, Calif., offers a unique service to customers who wish to order merchandise by phone, then drive to a "will call" outdoor service center where their order will be awaiting pickup. Or, if articles displayed or advertised by the store have to be transferred from a warehouse rather than being immediately available from local stock, then these items likewise are delivered to the "will call" window for subsequent pickup by "drive in" customers.

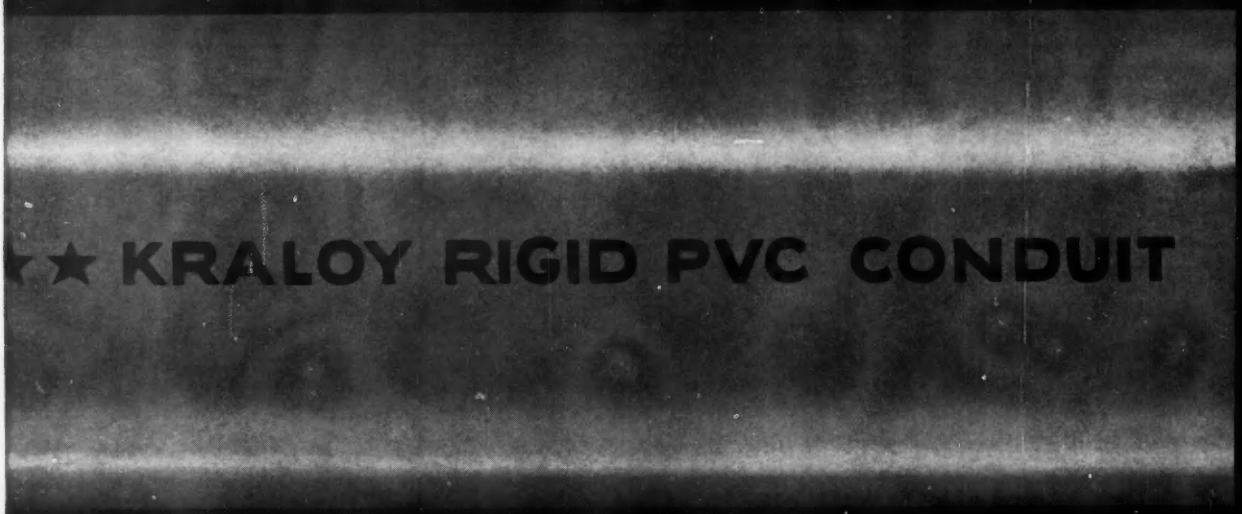
Even on cold winter days, customers stopping at this "will call" window are assured of complete comfort and protection against the weather, because two 4000-watt infrared heating units suspended above the waiting area are angled downward as shown in the photo to direct radiant warmth to customers assembled beneath a broad sidewalk-shielding canopy. Since the canopy likewise protects a convenient drive-in lane, motoring customers can complete their pickups and billing routines quickly and comfortably.

Infrared heating units, plus illuminated signs and incidental lighting and switching facilities, were installed by electrical contractors Luppen & Hawley.

TWO 4-KW RADIANT HEATERS keep customers warm during cold weather by directing invisible heating energy towards this will call and pickup area. Installation was by electrical contractors Luppen & Hawley, Sacramento, Calif., for department store in that city.

B.F.Goodrich

This



is now listed under the label service of ...permitting ABOVE GROUND use*

Already, conduit made of rigid Geon PVC has shown performance superiority in many miles of below ground installations.

Now conduit made of Geon vinyl by Kraloy/ Chemtrol, of Santa Ana, California, is included in the National Electrical Code for *above* ground use. Among the many advantages are these:

Corrosion resistance. Users report PVC conduit is their best answer to chemical attack by highly corrosive acids and alkaline fumes and vapors.

Fire resistance. Conduit of rigid PVC will not support combustion.

Unaffected by high humidity. Moisture and water will not penetrate rigid Geon.

Underwriters' Laboratories, Inc.

Lower cost. Installation is quick and easy.

For specific information on the use and limitations of PVC conduit, consult the new National Electrical Code, *Article 347*, or write B.F.Goodrich Chemical Company, Department AL-3, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

*Under provisions of revised National Electrical Code, Section 347.

B.F.Goodrich Chemical

a division of The B.F.Goodrich Company

Geon VINYLS

this
U.L. approved
KRALOY
rigid PVC conduit
is available now

from these
KRALOY
representatives

Anchorage, Alaska
John P. Bagoy & Associates BR 4-1884
Los Angeles, Calif.
Agencies Company MA 6-5444
San Francisco, Calif.
Robert J. Arthur YU 2-3483
West Vancouver, B.C.
H. M. Brown WA 2-8963
West Toronto, Canada
Morley Agencies, Ltd. EM 6-5619
Denver, Colo.
Jim Dawson Company AL 5-7194
Clearwater, Fla.
Fay-Shaw Company 446-7008
Atlanta, Ga.
Frank B. Davis TR 5-2278
Honolulu, Hawaii
Alfred E. Linzer & Associates 912-291
Chicago, Ill.
Crescent Electrical Sales Co. AL 2-2600
Indianapolis, Ind.
A. Lee Clifford & Co. ME 6-4449
New Orleans, La.
Art Wachter & Company JA 5-1744
Kansas City, Mo.
Curt Conrad Company BA 1-3990
Detroit, Mich.
R. Dykstra and Company WA 1-5630
Minneapolis, Minn.
Russ Gerde, Inc. WE 9-0071
Charlotte, N. C.
G. M. Hogshead Co. 375-5924
Albuquerque, N. M.
Ralph B. Black AM 5-0144
Buffalo, N. Y.
Vincent J. Brown Co. TL 2-1122
New York, N. Y.
W. D. Schofield Associates LO 9-1600
Cleveland, Ohio
Theodore M. Gage & Co. SK 2-4477
Philadelphia, Pa.
Wm. C. Welde & Sons EV 6-0925
Pittsburgh, Pa.
Morrow Sales GR 1-7973
Houston, Tex.
Brenner Electrical Sales CA 5-0766
Bountiful, Utah
D. O. Harvey AX 5-1201
Richmond, Va.
Charles C. Laney Agency BR 2-9059
Seattle, Wash.
Carlson Sales, Inc. AT 4-4630

Or Contact Your Local
Kraloy Chemtrol Electrical Distributor

Use Kralet Rigid PVC Electrical Boxes

Regional Sales Offices and Warehouses
Philadelphia 23, Pa.
Pier 36 N., Penn & Poplar WA 2-5989
Chicago 4, Ill.
2525 W. Armitage Ave. HU 9-7111
Dallas, Tex.
8815 Diplomacy Row ME 1-8650

KRALOY/CHEMTROL COMPANY
ELECTRICAL PRODUCTS DIVISION
402 W. Central Ave., Santa Ana, Calif.

Dry Drilling Speeds Cutting of Slabholes

Jim Seal, general superintendent for Fischbach and Moore's Los Angeles division, had a problem—to drill 325 holes, ranging from 1½- to 2⅜-in. in diameter, through a 12-in. reinforced concrete floor deck at United Air Line's new passenger terminal which was being rushed to completion at L. A.'s expanding jet airport. With upcoming deadlines demanding fast completion and with space on lower decks already finished, it was necessary to emphasize speed and also prevent water from dripping through to the lower level. Therefore Jim decided to do the job with a rotary-impact dry drill rather than use a diamond core tool.

Superintendent for the job Bill Louden was skeptical of the untried method. So, with foreman Chris Ferrick, he "tried before he buyed." The test showed that the tool was lightweight and highly portable; it did not require anchors on rough or uneven floor decks; holes could be angled close to walls without difficulty and water for cooling purposes was not required. For that reason only a small working area had to be cleaned of debris prior to drilling, and the danger of water dripping through to finished work below was eliminated as well.

Rotating at 1200-rpm and delivering 7200 impacts per minute, the core bit cut through the 12-in. reinforced slab in two minutes. This included cutting of a ⅜-in. steel reinforcing bar, the result indicating an average drilling rate of 6 in. per minute.

During the following two weeks the only difficulties experienced were (1) maintaining a steady 15-lb. pressure on the drill and (2) drilling in "green" concrete where rebars had a tendency to vibrate or "spring" against the bit.

The first problem resulted from operators' general tendency to lessen their pressures when they felt bits hit steel bars, and it was found necessary to maintain constant pressure in order to prevent carbide core-bit teeth from chattering and chipping. When this occurred it became necessary to remove the drill from the hole and remove the steel fragments.

This same tendency to chatter and chip occurred when drilling was required in new slabs which had not yet solidified thoroughly. However, by using a special core bit with V-shaped teeth, this problem also was solved.

In spite of these initial difficulties, considerable savings in time were noted. And, in one 2-hour period, Ferrick's men drilled a total of 35 holes. During this period it also was noted that many holes could be drilled within a small area without fracturing or spalling the surrounding concrete. And, to prove the point, as many as 11 holes were placed within a 12- by 18-in. area on several occasions.

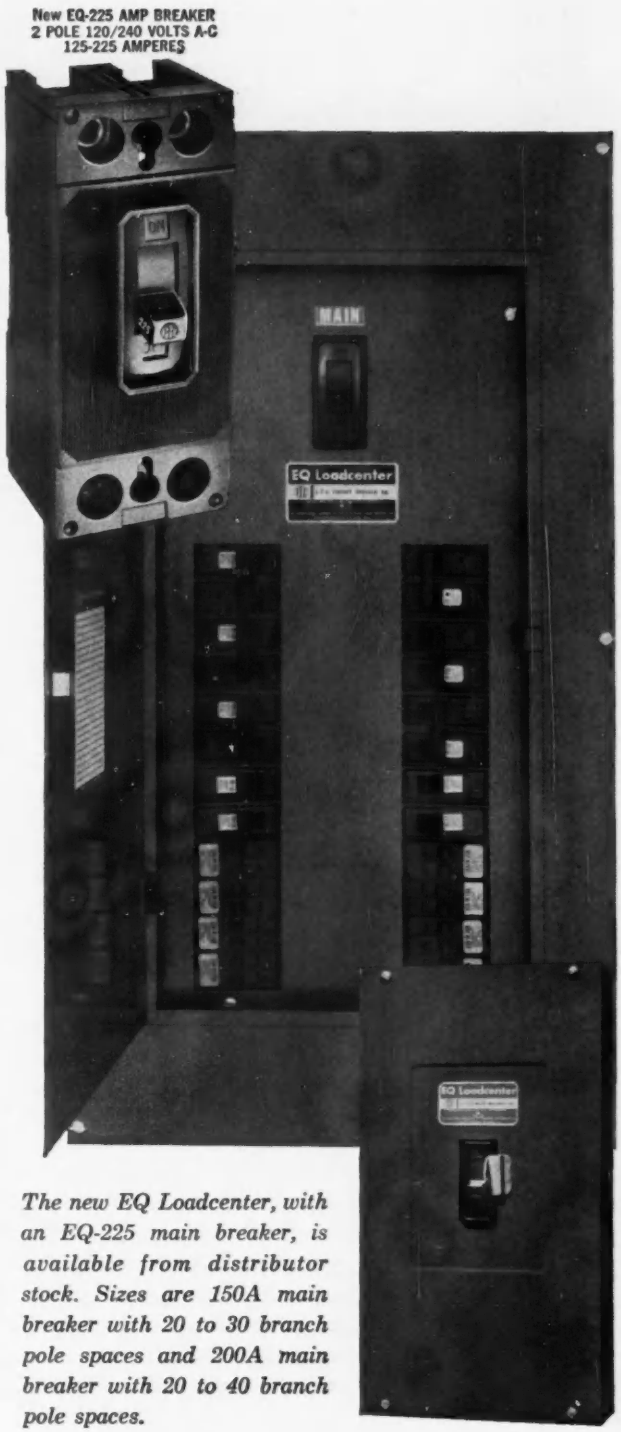
ROTATING at 1200 RPM and delivering 7200 impacts a minute, dry drill cuts through 12-in. reinforced concrete slab in two minutes. Without water for cooling, dripping is eliminated and the only operating requirement is a 115-volt power source, either ac or dc. Operator holds template in place with his feet until hole is started. Note how close tool can be placed to wall without inconvenience.

EXPERIENCE with dry drill indicates that constant pressure in the order of 15 lbs is essential to prevent chattering and chipping the bit when it strikes a steel reinforcing bar. When drilling through green concrete, special V-shaped teeth on core bit are recommended. Instructing the operator above is Lysle Tatro, engineer for Bill Jack Industries. Drill is called a Roto-Imp.

NEW EQ®-225 AMP. BREAKER

SAME FAMOUS I-T-E QUALITY

Now available under the I-T-E label are the new EQ-225 circuit breaker, new EQ-Loadcenter with 150A or 200A main breaker, and enclosed EQ-225 breakers .. (NEMA Type 1, 1B and 3) .. in ratings of 125, 150, 200 or 225 amperes. These new modern, compact devices provide positive protection against overload or short circuit conditions. The EQ-225 employs Quick-make, Quick-break, Trip-free mechanism action with common trip (not companion trip). A fault to ground automatically opens both poles of the breaker! Overcurrent protection combines the time proven thermal magnetic principle for positive protection against overload or fault conditions. For additional information, contact your nearest I-T-E District Office, or your local I-T-E Authorized Distributor.



The new EQ Loadcenter, with an EQ-225 main breaker, is available from distributor stock. Sizes are 150A main breaker with 20 to 30 branch pole spaces and 200A main breaker with 20 to 40 branch pole spaces.

for the Contractor who is Proud of his work

I-T-E CIRCUIT BREAKER COMPANY

Look how 17 GUARDIAN LIGHT *quartz/lite* FLOODLIGHTS illuminate this 120 foot x 175 foot lot!

21,000 square feet brilliantly lighted with an average intensity of 20 F.C.

Used car dealers represent a profitable potential for you. They need brightly illuminated lots to attract attention, as well as to display their cars. Hundreds of dealers throughout the country are using Guardian Light's *quartz/lite* floodlights to provide brilliant, economical, "showcase" lighting on their lots.

Let Guardian help you to profit on this market. Tell us the size and arrangement of your prospect's lots. We will furnish layout and engineering service without cost or obligation.

WRITE OR WIRE FOR DESCRIPTIVE BULLETIN. ADDRESS DEPT. E

GUARDIAN Light COMPANY
500 NORTH BLVD. OAK PARK, ILLINOIS
REPRESENTATIVES IN ALL PRINCIPAL CITIES
GUARDIAN LIGHTING
© 1962

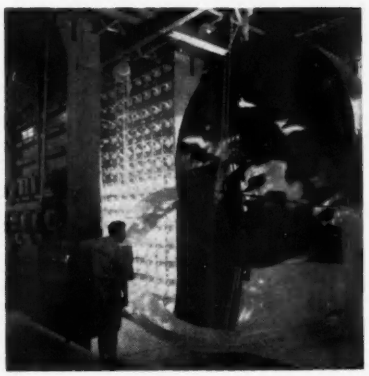
84-KW Infrared Oven Bakes 15-ft High Signs

Neon and plastic signs, some so large that they consist of 65 sections measuring 6 by 8 ft, are being manufactured by the Young Electric Sign Co., Salt Lake City. And, according to Tom Young, Jr., the trend is to still "bigger and better" assemblies. Making such big signs, however, poses some equally big problems, such as painting and drying a 7-color creation similar to the one shown in the accompanying photo.

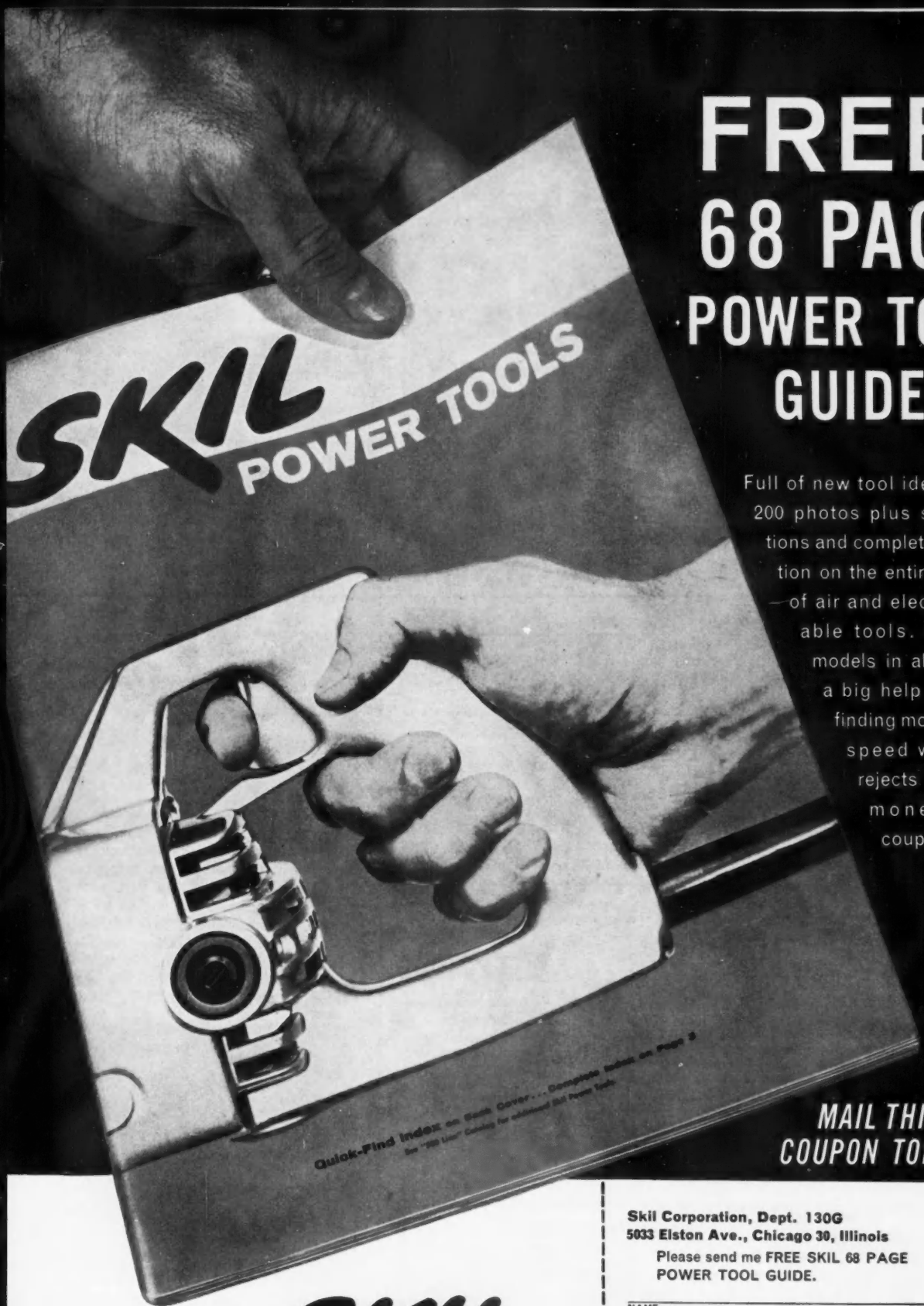
Up until a few months ago this was quite a headache, since multicolor painting, drying and masking required as much as three days per section. When multiplied by fabrication time and aggravated by storage problems, the manufacture and delivery of a large sign to meet a contract deadline was usually a tough assignment.

Therefore, to improve production flow without sacrificing quality, a 15-ft high infrared baking oven was installed with an adjustable-speed trolley conveyor running between two large, opposing, adjustable-gap, ceiling-supported halves. At present, each half measures 7½ ft in width and contains 112 clear 375-watt infrared lamps, each one mounted in a separate ft-square gold-plated reflector. Since the baking oven is constructed in modules, the over-all length of the assembly and the total number of lamps can be enlarged should future demands so dictate.

At present, the total of 224 lamps constitutes a connected electrical load of 84 kw, although service feeders and switchgear are suffi-



LARGE 7-COLOR sign sections can be painted and bake dried in seven hours in this 224-lamp 84-kw 15-ft high infrared oven. Prior to the installation of this assembly, the same cycle required three days, creating serious production, storage, quality and profit problems for the manufacturer.



FREE! 68 PAGE POWER TOOL GUIDE

Full of new tool ideas! Over 200 photos plus specifications and complete information on the entire Skil line of air and electric portable tools. Over 100 models in all! Can be a big help to you in finding more ways to speed work, cut rejects and save money. Mail coupon NOW!

MAIL THIS COUPON TODAY!

SKIL
POWER TOOLS

COUPON ALREADY CLIPPED? Get your own copy of the Skil Power Tool Guide by writing: SKIL Corporation, 5033 Elston Ave., Chicago 30, Illinois.

Skil Corporation, Dept. 130G
5033 Elston Ave., Chicago 30, Illinois

Please send me FREE SKIL 68 PAGE POWER TOOL GUIDE.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Pick the One Designed for the Job!

For All Normal Wiring Installations ..... **Type L. T.**

For most of your jobs Type L.T. Liquatite will give wiring complete protection against any and all contamination. It's impervious to water, oils, chemicals, corrosive atmospheres. No more periodic wiring replacements. J.I.C. approved.

For High-Heat Locations ..... **Type H. T.**

Hi-Temp Liquatite is designed specifically to safeguard circuits in extra-hot areas. Jacket of special grade, tough polyvinyl chloride serves a dual purpose: withstands temperatures to 220°F.

For Wet Spot Use ..... **Type L. A.** **Type C. S. A.**

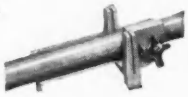
Type L.A. Liquatite conforms to the provisions of Article 351 of the National Electrical Code under "Liquid Tight Flexible Metal Conduit." It positively and permanently resists wet, hot and corrosive elements.

Type C.S.A. Liquatite conforms to all provisions of the Canadian Electrical Code rules. Seals out and resists flame, liquids and vapors, including most acids and chemicals.

Where Weight is a Problem ..... **Type A. L. T.**

Electri-Flex Type A.L.T. Liquatite is a square locked (interlocked on larger sizes), *extra lightweight aluminum* flexible conduit. Moistureproof Liquatite absorbs motion, vibration and bending indefinitely.

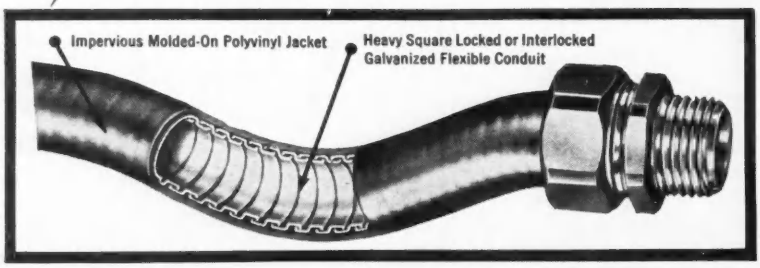
New portable cutting vise for making clean, square cuts of Liquatite and other types of tubing and conduit... can be hand held for use on the job or bench mounted in the shop.



Write today for free Liquatite sample, costs and name of Distributor nearest you.

ELECTRI-FLEX COMPANY

P.O. Box 128C • Roselle, Illinois



ciently sized to double this loading if the need arises.

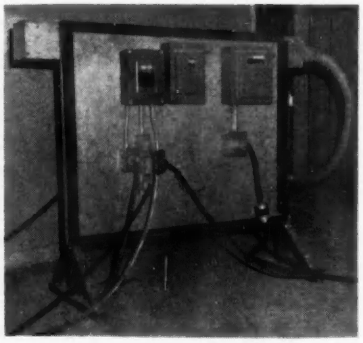
As to results; an 8- by 10-ft 7-color section now can be painted and bake dried in seven hours, rather than three days, while these reductions in production time also have resulted in savings in storage floor space, a better quality product and reduced over-all production costs.

As indicated by the array of switches mounted on the rear of the left-hand section, lamps are controlled by zones, so that only those lamps required for a particular job need be turned on. In this manner, area heat may be closely regulated. And, by adjusting the speed of the overhead conveyor, the complete drying cycle may be scheduled with accuracy.

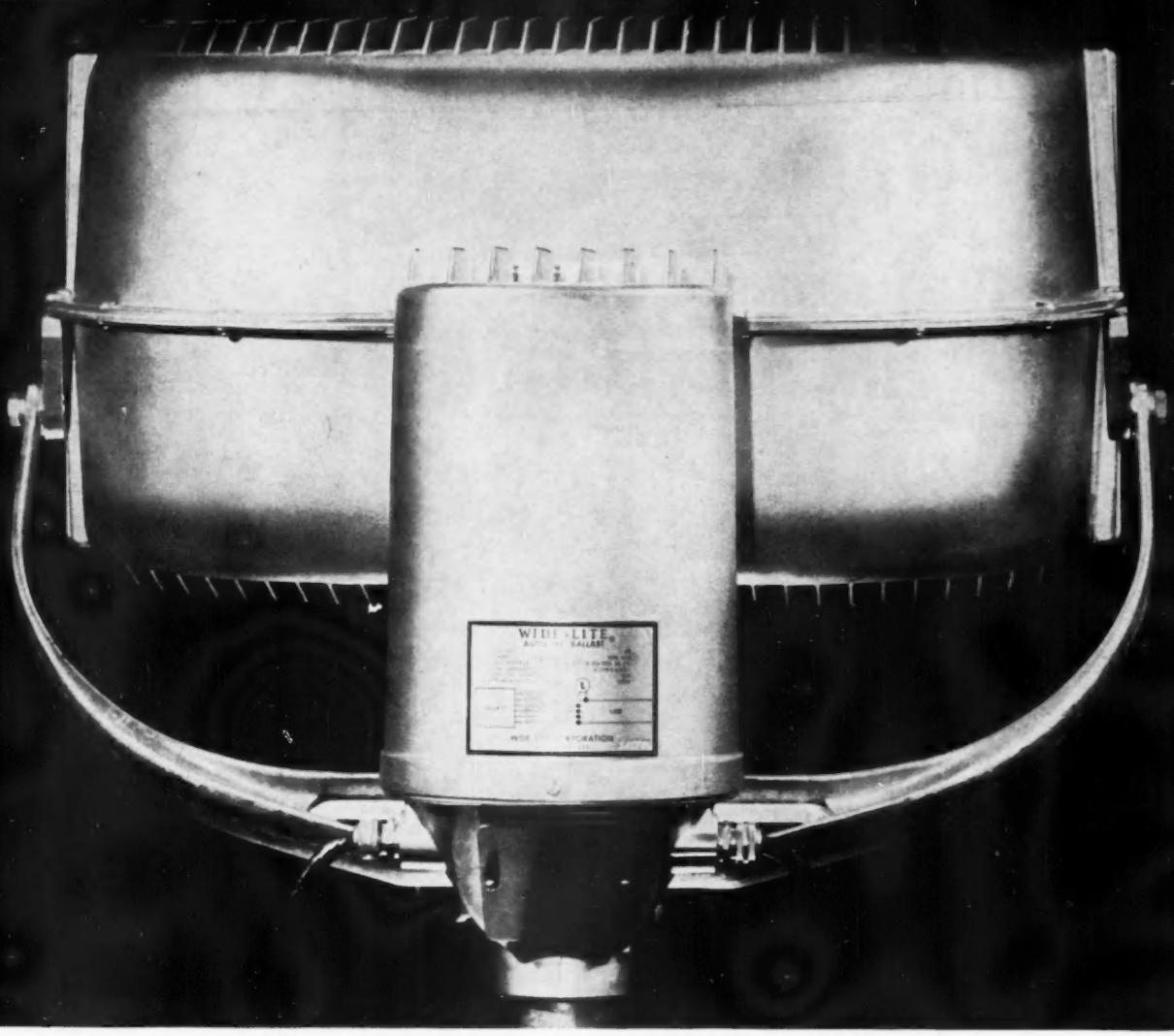
The oven, plus all electrical distribution and control equipment, was installed by Utah Electric Co., Salt Lake City, while design was based upon engineering data submitted by Allen Rudy, Utah P&L, and Keith Lagerstrom, Fostoria.

Movable Panel Provides Temporary 2-Voltage Power

During construction of facilities at Los Angeles' new passenger airport terminal, Fischbach and Moore's field crews obtained 110- and 220-volt power from a series of compact, rugged, neat distribution panels; one of which is pictured in accompanying photos. Measuring 3- by 4-ft and formed from ¾-in. plywood, each panel is mounted to a corner-welded frame of channel sections, held vertical by braced pedestal cross-members as shown. A 3-wire feeder protected by flexible armor delivers power initially to a



PLYWOOD PANEL is framed by corner-welded steel channels supported by braced pedestals, while 110- and 220-volt service is obtained from locking-type plugs controlled from related breaker assemblies.



This is a photo of longer lamp life!

Why?

Because it shows the exclusive features built into every Wide-Lite floodlight to assure proper cooling. And mercury vapor lamps last longer when cooled properly!

Notice the deep, die-cast fins in the top and bottom of the fixture. How many other 1000-watt floodlights have the 1,872 square inches of heat-dissipating surface the Wide-Lite unit has? You guessed it. None.

Notice, too, the ballast location. It's connected to the fixture for easy one-unit mounting. But it is a *separate* component so that ballast heat cannot combine with lamp heat to compound the problem. And it has 348 square inches of heat-dissipating surface all its own.

Besides making lamps last longer, these exclusive heat control features give Wide-Lite floodlight owners another big advantage: proper color-correction. Because if a color-corrected mercury vapor lamp runs too hot, it loses its ability to "correct" the color of the light it projects, and you get the eerie coloring effect of clear mercury vapor lamps.

Next time you see a big Wide-Lite floodlight on the job, take a look at the 2,220 square inches of cooling area built into the fixture and ballast. That's 2,220 reasons why the Wide-Lite is so provably better.

Why not write for all the *other* reasons?

WIDE-LITE CORPORATION, a Division of Esquire, Inc., Dept. YB 111, 4114 Gulf Freeway, Houston 1, Texas.

WIDE-LITE.

FLOODLIGHTS
BALLASTS
INDOOR LUMINAIRES

Yesterday your best customer –
Today a dead loss –

SELL CUSTOMERS

KIDDE FIRE DETECTION–

THEY NEED IT!

YOU MAKE A GOOD PROFIT! 60% of all businesses that suffer severe-loss fires shut their doors forever. Make sure *your* customers stay in business! Sell them the modern Kidde FYRINDEX Detection System. They need it. You'll turn a good profit every sale you make.

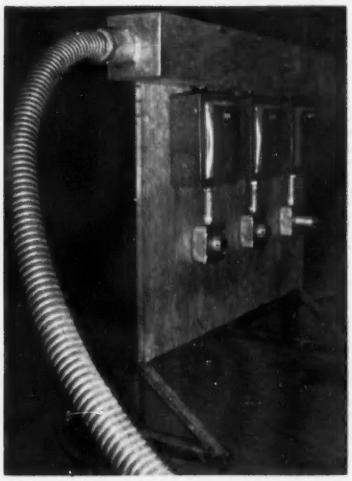
EXPANDABLE—EFFICIENT Kidde FYRINDEX, built around the compact detector shown above, is an expandable system that can serve one room or acres of factory space. Customers like the FYRINDEX. It not only responds quickly, but can be heat tested periodically without damage. Customers can also paint the FYRINDEX detector without impairing its efficiency. It is unaffected by dust, humidity, corrosive air particles and vibration.

SIMPLE–
EASY TO INSTALL – Components: FYRINDEX Spot Detector, control box, distinct horn, wiring. Detector operates on fixed temperature and rate of rise principles, is rated to cover 2500 sq. ft. It mounts on a standard 3½" box, is provided with knockouts for surface and concealed wiring, meets U.L. and F.M. specifications.

FOR MORE INFORMATION – get in touch with your electrical wholesaler or write direct to Kidde.

Kidde

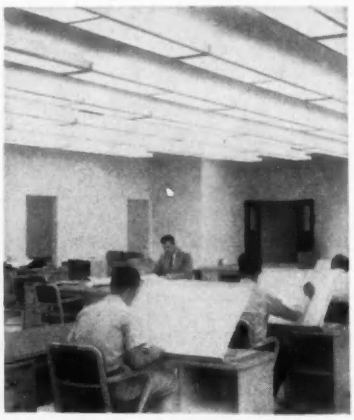
Kidde Ultrasonic & Detection Alarms Division
Walter Kidde & Company, Inc., 785 Brighton Road, Clifton, N.J.



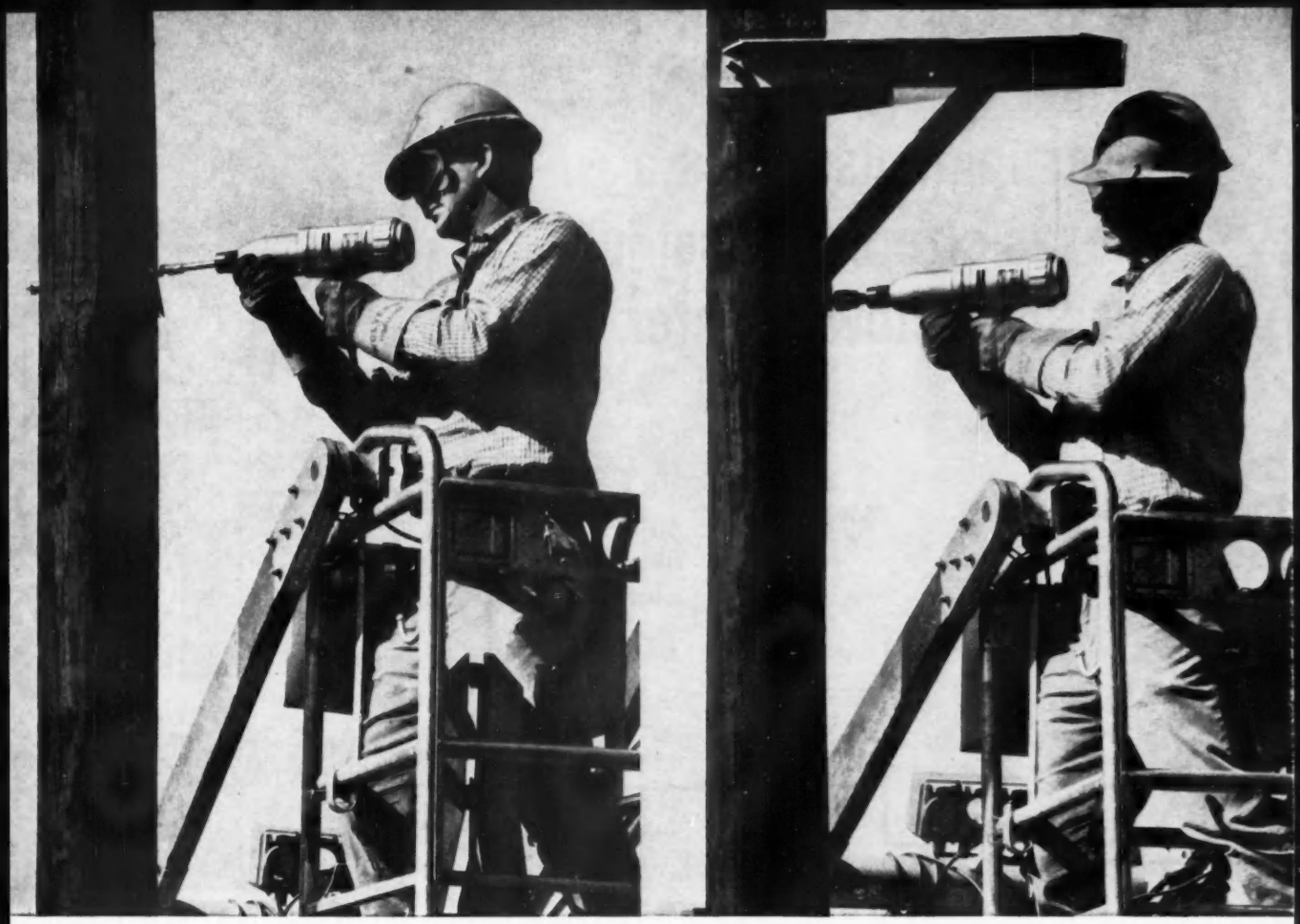
SQUARE RACEWAY provides ample wiring gutter across top of movable distribution center, while 3-wire feeder for same is carried through and protected against physical damage by flexible conduit.

4- by 4-in. square side-hinged raceway header raceway, with nipples and short sections of thinwall conduit then providing wiring access to breaker panels and locking-type receptacles.

As noted, one side of the panel contains three 220-volt outlets, while a fourth 220-volt panel and a 4-circuit 110-volt breaker assembly is mounted on the other side. With positive control for each circuit and with extension plug-in points raised above floor level to minimize possibilities of damage or contamination by construction operations, these sturdy, dual-voltage, easily-moved distribution centers served as practical service aids for all trades.



MAINTAINED LIGHTING intensities averaging 275 footcandles are obtained by Marmon Div. of Aeroquip Corp., Los Angeles, Calif., by installation of four-lamp ceiling-mounted diffusion-panel fixture installation consisting of luminaires in continuous rows, 4-ft on centers, operating at 430-milliamps.



Quick-change artisan

Now he drills . . . now he fastens. Anything two can do, this **one** tool does better, does it faster, and with a greater measure of safety. It makes every worker worth more in man-hours per labor unit.

We've built an integral hex chuck into Black & Decker's reliable heavy-duty electric impact wrench and re-designed the wrench to serve as a drill as well as a bolting tool. Now you can drill holes using hex shank augers up to 1-1/16", then switch in seconds to a socket drive to fasten guide wire clamps and bolts, strand clamps, pole steps, cross arm braces, extension arms . . . all with this one long-life B&D tool.

What makes it **safer** is the elimination of operator torque reaction—important when drilling in dangerous areas (like on utility poles). What makes it **better** is its positive-locking, one-piece hex chuck and anvil made of special tool steel for longer life . . . and its sealed, roller-type anvil bearing in a die-cast barrel to give improved performance. Two sizes are available: Model 625-1 is the larger; Model 624-1 is the smaller. Both will bore holes in 1/16" increments from 7/16" to 1-1/16". The smaller tool weighs half as much, works half as fast. There's a place for both. Try them.

Sold by leading distributors everywhere.

For sales or service look in the Yellow Pages of your telephone book under

TOOLS ELECTRIC

Black & Decker®
MAKER OF THE WORLD'S FIRST CORDLESS ELECTRIC TOOLS

The Black & Decker Mfg. Co., Dept. 1207
Towson 4, Md. (In Canada: Brockville, Ont.)

☐ Please arrange for a demonstration of_____

☐ Please send me more information on_____

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

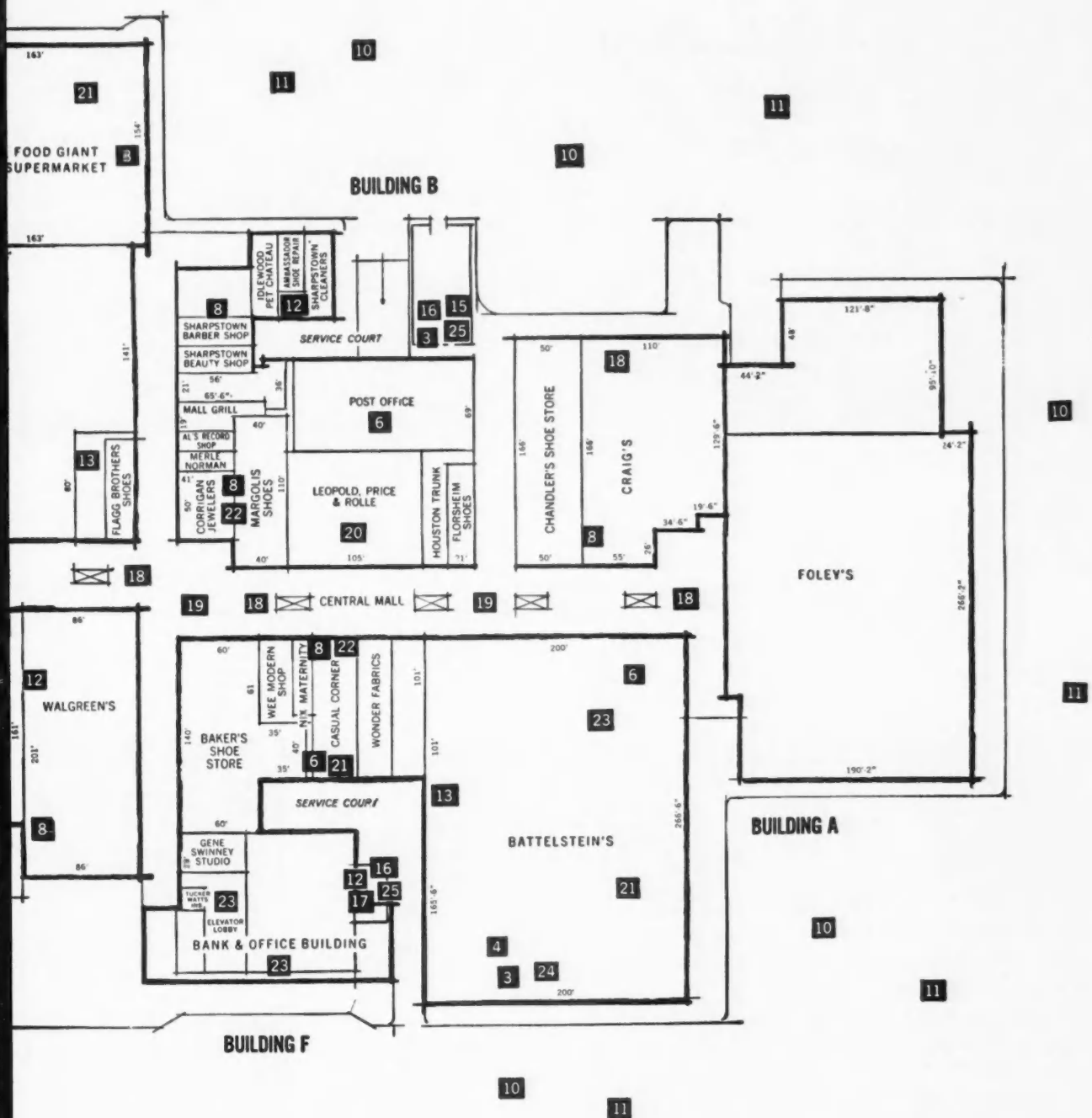
☐ Drills
☐ Hammers
☐ Saws
☐ Sander-Grinders

ADVERTISEMENT

Westinghouse does a Texas-size electrical job at Sharpstown Center

1. Distribution Transformers
2. Bus Duct
3. Switchboard
4. Motor Control Center
5. Air Conditioning Starter
6. Mainliner Luminaires
7. AB Circuit Breakers
8. Lighting Panelboards
9. Corvaire Luminaires
10. OV-50 Parking Area Luminaires
11. Mercury Vapor Lamps
12. Circuit Breakers
13. Dry Type Transformers
14. Rain Tight Starters
15. Safety Switches
16. Meters
17. Distribution Panelboard
18. Roof Mounted Starters
19. Super Hi Output Fluorescent Valance Lighting
20. Air Conditioning
21. Superliner Fixtures
22. Panelboards
23. Incandescent Downlighting
24. Lifeline Motors
25. Motor Control

J-94186-1


BUILDING B
FOOD GIANT SUPERMARKET
IDLEWOOD PET CHATEAU
AMBASSADOR SHOE REPAIR
SHARPSTOWN CLEANERS
SHARPSTOWN BARBER SHOP
SHARPSTOWN BEAUTY SHOP
SERVICE COURT
MALL GRILL
AL'S RECORD SHOP
MERLE NORMAN
CORRIGAN JEWELERS
MARGOLIS SHOES
POST OFFICE
LEOPOLD, PRICE & ROLLE
HOUSTON TRUNK
FLORSHEIM SHOES
FLAGG BROTHERS SHOES
CHANDLER'S SHOE STORE
CRAIG'S
FOLEY'S
CENTRAL MALL
WALGREEN'S
WEE MODERN SHOP
MATERNITY
CASUAL CORNER
WONDER FABRICS
BAKER'S SHOE STORE
SERVICE COURT
GENE SWINNEY STUDIO
TUCKER WATTS INC.
ELEVATOR LOBBY
BANK & OFFICE BUILDING
BATTELSTEIN'S
BUILDING A
BUILDING F
1540 feet

J-94186-2

Owner: Sharpstown Realty, Houston • Architect: Sidney H. Morris, Chicago, Ill. • Associate Architect: Claude E. Hooton, Houston
Consulting Engineers: Bullock, Wright, & Miller, Inc., Houston • Electrical Contractor: Wert Sharp Electric Co., Houston
General Contractor: John C. Burns Construction Co., Houston • Westinghouse Distributor: WESCO, Houston

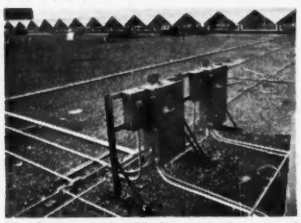
Westinghouse at Sharpstown Center (cont.)

Houston's new 750,000 sq. ft. Sharpstown Center looks to Westinghouse equipment to help accommodate 2 million customers—an estimated $75,000,000 market. Big, even for Texas, Sharpstown's 77 acres include 2 million sq. ft. parking area for 6,000 cars. It's on 261 overhead parking lights that the Westinghouse brand first meets and greets the shopping public.

The major construction problem was coordination of mechanical and electrical system requirements to give all stores the best merchandising environment possible. Westinghouse engineers and WESCO representatives from the Houston distribution outlet worked closely with the developer, consultants and contractor to meet tight dates, sometimes with overnight deliveries. The grand opening was on schedule, just three days after Hurricane Carla, in September, 1961.

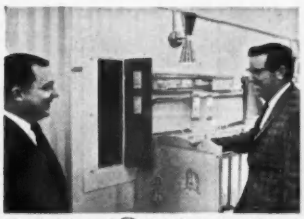
Westinghouse, and its chain of distribution outlets, stands ready to help any shopping center project—be it a neighborhood strip or a $14 million Sharpstown. You get one-stop shopping, one source, one contact, one contract, one responsibility. Think about it for your next project. *You can be sure . . . if it's* **Westinghouse**

Foreground: Two of 261 OV-50 Silverliners, an invitation in light to 6000 car parking. Rugged OV-50's were subjected to Hurricane Carla shortly after installation without a single unit failure.

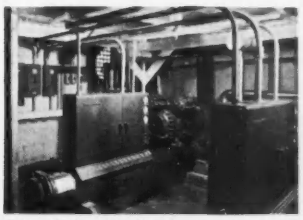


Roof-mounted Life-line starters and circuit breakers in weather-proof enclosures control and protect mall air conditioning motors.

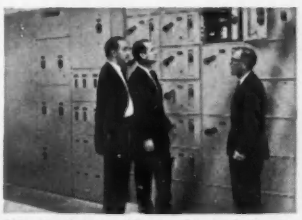
J-94186-3



Flush trim of Ⓦ lighting panelboard blends with sales fixtures in Kresge's Variety Store. AB de-ion circuit breakers give positive protection, convenient operation.



Two 40-ton Westinghouse air conditioning compressor-condenser units keep Bond's Clothing Store cool and comfortable for customer comfort.



Westinghouse Motor Control Center located in Battelstein's conveniently groups starter and breakers. Control Centers offer flexibility through modular and interchangeable units.

No annoying power hum for Flagg Shoe customers. Light weight DT-3 dry type transformers have extremely low sound levels—can be mounted almost anywhere.

Power supply by Ⓦ outdoor ventilated copper bus duct carries full building load—installs fast to help meet construction deadlines.

Three-lamp Superliner fixtures are economical, yet versatile. Ideal light supply for applications such as this Food Giant Supermarket.

Ⓦ Mainliner fluorescent luminaires bathe fashionable Casual Corner women's wear shop in 150 fc of diffused light—create quality atmosphere vital to tenant.

Construction team takes a coffee-break at Walgreens; R. E. Jordan, V.P., Sharpstown Realty; Jacque McCroskey, Ⓦ; W. C. Swain, WESCO; Wert Sharp, Electrical Contractor; Frank W. Sharp, Owner; Rex Bullock and George Wright, Consulting Engineers.

J-94186-4

PASS THE POWER . . . HEAVY-DUTY POWER TOOLS AND HOISTS CAN BE SAFELY AND EFFICIENTLY MOVED, ON THE ASSEMBLY LINE, BY USING BULLDOG INDUSTRIAL TROL-E-DUCT® MAKE ANY LENGTH RUNS WITH TAP-IN POWER ANYWHERE. SUITABLE FOR HIGH-CYCLE OR SUPER-CYCLE USE. CONTACT YOUR LOCAL I-T-E SALES OFFICE TODAY.....IMAGINEERING THROUGH ELECTRICITY.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.

FOR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

  Use first line of boxes. Insert item numbers of products on which more information is desired.

- **CATALOGS, BULLETINS AND ENGINEERING DATA:**

  Use second line of boxes. Insert item numbers of literature desired.

- **ADVERTISEMENTS:**

  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

Please send me without obligation further information about the following: 7/62

Product News and Product Briefs, Item Number

Catalogs and Bulletins, Item Number

Advertisement on Page

NAME .....TITLE.....

COMPANY .....

ADDRESS .....

.....

ELECTRICAL CONSTRUCTION AND MAINTENANCE — A McGraw-Hill Publication

NOT GOOD AFTER OCTOBER 1, 1962

Please send me without obligation further information about the following: 7/62

Product News and Product Briefs, Item Number

Catalogs and Bulletins, Item Number

Advertisement on Page

NAME .....TITLE.....

COMPANY .....

ADDRESS .....

.....

ELECTRICAL CONSTRUCTION AND MAINTENANCE — A McGraw-Hill Publication

NOT GOOD AFTER OCTOBER 1, 1962

IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

Read your own personal copy.

Get the latest time and money-saving methods for

- estimating
- wiring
- maintenance

every month in

ELECTRICAL
CONSTRUCTION and MAINTENANCE

Fill in this card and mail it TODAY!

NEW SUBSCRIPTION APPLICATION CARD

YES SIR! I want to know the latest electrical estimating, wiring and maintenance methods! Enter my subscription to ELECTRICAL CONSTRUCTION & MAINTENANCE for a full year's service (13 helpful issues) for only $3.*

☐ Check here for two years at $4* (You save $2)

(* United States only. Canadian and overseas rates on request.)

Please print — and fill out completely

NAME ..... TITLE OR POSITION.....

ADDRESS ☐ Home ☐ Business.....

CITY.....ZONE.....STATE.....

CO. NAME.....

OUR MAIN BUSINESS IS.....

I am in charge of Electric Work ☐YES ☐ NO

Operate a Motor Service Shop? ☐ YES ☐ NO

Person in charge of Elec. Work is.....

Please do not write in this box.
EC-
U-

EC-RS-7/62

Send No Money Now—Simply Mail Card Today!

PLACE 3¢
STAMP
HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

PLACE 3¢
STAMP
HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

FOR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**
  Use first line of boxes. Insert item numbers of products on which more information is desired.
- **CATALOGS, BULLETINS AND ENGINEERING DATA:**
  Use second line of boxes. Insert item numbers of literature desired.
- **ADVERTISEMENTS:**
  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed In The United States

POSTAGE WILL BE PAID BY

McGRAW-HILL PUBLISHING CO., Inc.

Electrical Construction & Maintenance

330 WEST 42nd STREET

NEW YORK 36, N. Y.

N O W

is the time to put

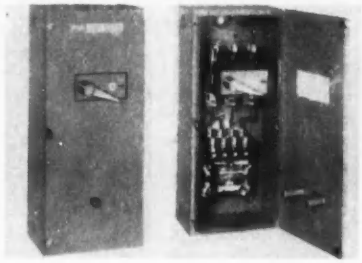
ELECTRICAL CONSTRUCTION and MAINTENANCE

to work for you!

Mail the attached card

T O D A Y

Product News



Starters (1)

A new "A Plus" line of combination motor starters featuring a single-handle operating mechanism that meets maximum industrial safety requirements has been introduced. The line is available with fusible disconnect switches featuring A Plus integral handle. Starters in NEMA Sizes 0 to 4, reversing and non-reversing, are available for operation up to 600 volts maximum in NEMA Type 1 enclosures. Unit is provided with a handle locking bar that accommodates up to three padlocks to insure complete safety to maintenance personnel. Switches can be locked in the "off" position with door either closed or open.

Federal Pacific Electric Co., 50 Paris St., Newark, N. J.

Drill (2)

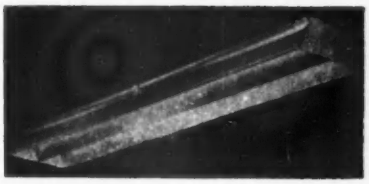
A new concrete core drill has been announced. Weighing 55 lbs, this machine can be quickly positioned to drill holes up to 2½ in. in dia. Unit uses diamond core bits for use in drilling reinforced concrete and other masonry materials. The base is a vacuum pad which holds the rig to walls or floors with 2500 lbs pressure in ten seconds. Drill motor may be readily removed from stand for hand-held drilling of occasional holes. Model K-385 is furnished complete with drill motor, stand, and oilless vacuum pump.

Kor-It Co., Inc., 991 Richard Ave., Santa Clara, Calif.

Cordless Tools (3)

Four new cordless tools have been developed for the industrial, commercial and service fields. Each of these new tools operates from a self-contained energy pack (battery) and completely eliminates the conventional power cord which required accessibility to a receptacle outlet. The new industrial-duty tools include: ¼-in. drill, ⅜-in. drill, a 2-speed ⅜-in. drill and a 2-speed ½-in. drill. The silver-cadmium power pack for each unit is part of the handle assembly, and can be recharged at least 400 times with the charger that comes with each unit.

Black & Decker, Towson 4, Md.



Fixtures (4)

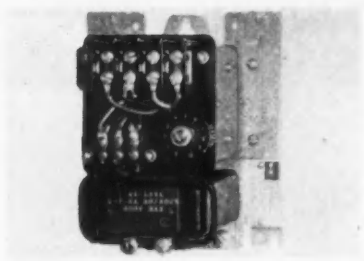
A new line of industrial fixtures designed around the Power Groove lamp is an 18-in. wide fixture utilizing parabolic shaped reflectors to control light in achieving high visual comfort. Fixtures are finished in diffuse Alzak or baked white enamel. "Powerlumes" are also made with a wire guard making them ideal for use as gymnasium lights or other applications where a guard is needed. Brochure is available.

Solar Light Manufacturing Co., 1990 North Mannheim Road, Melrose Park, Ill.

Lampholder (5)

An outdoor lampholder with photocell control has been introduced. It can be used for a wide variety of lighting purposes. The photocell lampholder switch will operate satisfactorily on voltages ranging from 105 to 130 ac and at temperatures ranging from minus 40°F. to plus 160°F. The capacity of switch is five amps at 120 volts ac or 600 watts, but this must be an incandescent lamp load, not fluorescent.

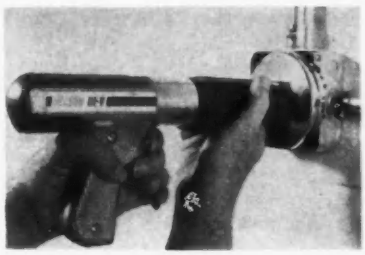
Bryant Electric Co., Bridgeport, Conn.



Relay (6)

A new ac load current relay which provides an adjustable, current sensitive device for monitoring load currents. It features a high degree of repetitive accuracy and has an over-all current range from 1-450 amps. Operating directly from the line current being monitored, Bulletin 13542 is suitable for applications on grinder and hammer mill motors, and conveyor and feeder applications to initiate secondary control functions. Available in open or NEMA 1 enclosed types.

Cutler-Hammer, Inc., 315 North 12th St., Milwaukee 1, Wis.

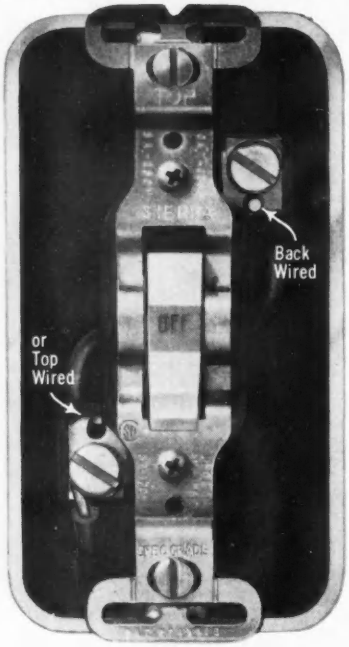


Powder-Actuated Tool (7)

New Nelson-HI-V high velocity powder-actuated tool provides safer fastening operations on a wide range of electrical and other building construction and maintenance work. It comes with a four-in-one guard that can be used interchangeably with a closed shield during the installation of a junction box, with a half-shield or anti-spall plate or as a door buck guard. Barrel projects when gun is "cocked" so that it will not stand upright on scaffolding, ledges or shelves unless it is in an open breech position. Designed for rapid conversion from ¼ in. to ⅜ in. barrel to accommodate a wide range of fastener sizes, it uses and automatically ejects special sealed plastic powercaps which provide identification.

Gregory Industries, Inc., Lorain, Ohio

SIERRA MERCURY SWITCHES



TESTED

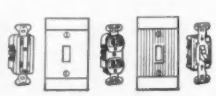
AT OUR FACTORY— NOT IN YOUR BOX

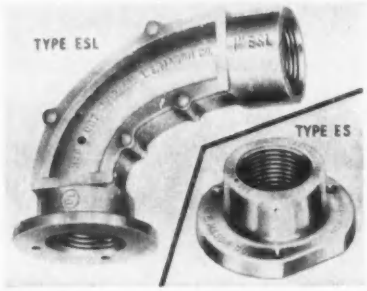
Some year's ago Sierra began the unprecedented procedure of testing each and every Mercury Switch under load conditions. Sierra has always contended that the place to verify a product's performance is at the factory—not after you get it in the box.

Sierra Mercury Switches are available in 1- & 2-pole, 3- & 4-way; and Sierra-lite with neon-lighted toggle handle.

SIERRA ELECTRIC CORPORATION
15100 SOUTH FIGUEROA STREET
BOX 85, GARDENA, CALIFORNIA

Write for more information and catalog

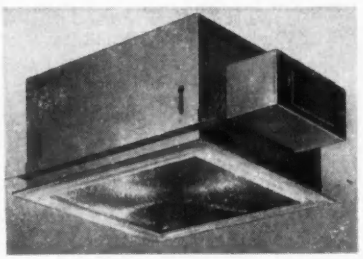




Fittings (8)

"Electro-Sert" fittings are threaded to conduit and firmly screwed or toe-nailed to deck before the concrete pour. They leave clean-threaded opening flush with ceiling line after concrete forms are stripped. Fabrication of conduit drops and box assemblies is simplified. Drops can be measured from ceiling elevation to wall switches or outlet boxes and cut to uniform lengths. Threaded conduit drops can be installed by screwing into Electro-Serts imbedded in the concrete, flush with ceiling line. They are available in two styles. Type ESL is a sweep-ell design which eliminates bending conduit and is particularly applicable for use in concrete slabs 4 in. or more in thickness. Type ES is a flange design for use where the contractor makes his own bends in slabs 5 in. and up.

L. E. Mason Co., 98 Business St., Boston 36, Mass.



Recessed Downlight (9)

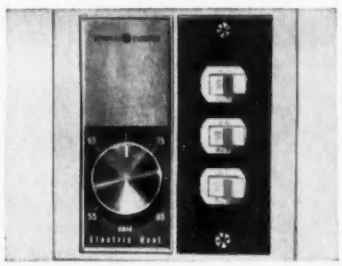
A newly developed recessed downlight, series "68 Line," is slim in appearance with cast aluminum door in frame. Pole relamps from floor. One-piece anodized aluminum reflector, choice of prismatic diffusers, and aluminum finish with baked-on lacquer coating. Easy installation in plaster, acoustical tile or metal pan ceilings. Adjustable socket assembly, permitting choice of lamps up to 300 watts medium base. Literature is available.

McPhilben Mfg. Co., Inc., 1329 Willoughby Ave., Brooklyn 37, N. Y.

Transformer (10)

A new line of miniature 600-volt current transformers (Type MM) is available in current ratings through 800:5 amps with bar type for meter cabinet applications or through type for direct cable application. Rating plates are color coded for identification. Epoxy-resin molded for indoor-outdoor maintenance-free service, this transformer gives high accuracy for light duty metering. The 5-lb unit is especially adaptable for control panels, meter boxes and for direct mounting on system cables.

Allis-Chalmers Manufacturing Co., Milwaukee **1,** *Wis.*



Switch Combination (11)

Electric switches and an electric heating thermostat combined in a single outlet box are now available. Thermostat is HWC-17 or 18 which contains a liquid-filled sensing knob for temperature differential of ½ degree F and a range of 55 to 85 degrees F. HWC-17 thermostat is a single-pole unit with "cold" setting and HWC-18 is a double-pole device with "off" position. Both are rated at 22 amps, 240 volts ac. Switch combinations can include three toggle switches, two switches and an outlet, two switches and a pilot light, or other similar desired combinations.

General Electric Co., Appliance Park, Louisville, Ky.

Drill (12)

A new masonry drill, called Model "305-G," has been added to this line of industrial-type diamond drills. The 5½-hp gasoline engine and gear-box assembly are mounted on a screw feed column directly above and in line with bit travel. This power unit provides plenty of power for rotating bits up to 6 in. in diameter. Interchangeable air and electric power units are also available for the "305-G."

E. J. Longyear Co., Longyear Building, Minneapolis **2,** *Minn.*

Now! FOR THE Smaller ELECTRICAL CONTRACTOR

A Brand **New** Price Book

Low Cost

Compact

Completely Illustrated

A "Cinch" to Use

Get The Full Story Quick →

NATIONAL PRICE SERVICE Dept. AQ-27
4525 WEST 160 STREET CLEVELAND 35, OHIO

GENTLEMEN:

SEND FULL STORY ABOUT *QUICK QUOTE*, PDQ.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

DONGAN
QUIET DRY TYPE
TRANSFORMERS

Dongan has specialized in the manufacture of dry type transformers for more than 50-years. This length of service to the electrical industry assures you of high quality, dependable transformers. Carefully built to your requirements, they will give long, quiet service.

DONGAN DRY-TYPE TRANSFORMERS are made in both Class B 80° Cent. Rise and Class H 150° Cent. Rise. Single phase transformers, 25 V.A. to 100 KVA; three phase, 3 KVA to 300 KVA. Suitable for indoor or outdoor applications. Designed for wall or platform mounting. All have roomy wiring compartments.

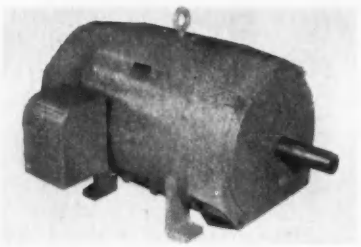
Sizes 5 KVA and larger feature tap-changing and voltage-changing terminal board equipped with solderless connectors for speed hook-up. Built to meet or exceed NEMA specifications.

Dongan also makes transformers for-signaling-machine tools-control-buck and boost-high voltage secondary for oil and gas burners-neon signs.

DONGAN ELECTRIC MFG. COMPANY

2980 Franklin Street **Detroit 7, Michigan**

Telephone: LO-7-3974



Motor Frames (13)

New dc motors and generators (Type SK-H) frame diameters 580 and 680, with reduced inertia for faster response, are available. Typical motor ratings on the 586 frame are 250 hp at 1150 rpm, 240 volts dripproof enclosure and 400 hp at 1150 rpm on the 686 frames. At 1150 rpm, corresponding generator ratings on the 586 and 686 frames are 170 and 320 kw, respectively. Improved insulation and commutation, lengthened armature, with decreased diameter, result in reduced inertia to give the necessary response for automated production line.

Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*

Rectifiers (14)

A new line of silicon diode rectifiers for various industrial applications has been announced. Standard accessory components include circuit breakers, diode protective fuses, voltmeter and ammeter. Currently available in sizes to 500 kw, input voltages to 600 volts, 3-phase ac, output 250 volts, two-wire dc or 125/250 volts, 3-wire dc.

Marcus Transformer Co., Inc., Rahway, N. J.

Drills (15)

Two new heavy-duty impact drills have been introduced. High frequency impact action together with high speed rotation produces 15,000 to 25,000 impacts per minute, depending on load. It creates a non-destructive, disintegrating action which drills reinforced concrete, brick, masonry tile, ceramic tile, concrete pipe and every type of masonry material. It is designed to cut through these materials without chipping, cracking or breaking out when close to an edge. Using spiral carbide bits or carbide tipped core bits, drills bore holes from $\frac{3}{8}$ to 5 in. in dia. Drills are designed for one-man operation.

The Stanley Works, New Britain, Conn.

GENERAL ELECTRIC SILICONE RUBBER INSULATION

Big in advantages Small on installed cost

Most engineers know that silicone rubber makes a superior insulation for cable. The chart below demonstrates it. But do you know that the price of silicone rubber insulation is surprisingly low when the total installed cost of the job is figured?

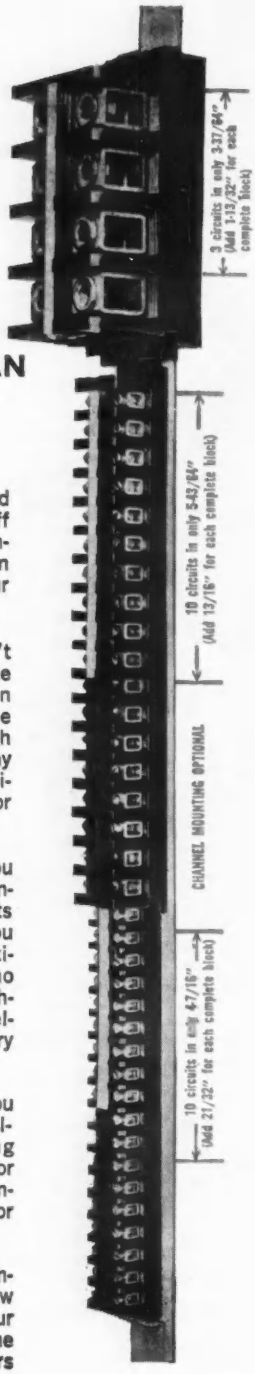
That's because G-E silicone rubber insulated cable gives you twice the current capacity, twice the overload protection of ordinary cable. In old installations, silicone rubber cable can be used in existing conduits without excessive reconstruction. On new installations you are buying the extra capacity and overload protection needed in the years ahead. Usually takes much less work to install it, too.

Typical Properties of Cable Insulations	Silicone Rubber	SBR Rubber	Butyl Rubber	Oil-Base Rubber	Polyvinyl Chloride	Polyethylene	Polytetrafluoroethylene
Maximum Temperature Rating	250°C	75°C	90°C	75°C	105°C	75°C	250°C
Insulation Resistance (Megohm Constant)	30,000	2,000	30,000	21,000	2,000	50,000	50,000
Power Factor, %	0.1	4.5	3.0	5.0	5-8	0.05	0.03
Tensile Strength, psi	1,200	800	800	1,200	1,500	1,500	2,000
Elongation, %	500	350	400	300	200	400	150
Heat Aging @ 200°C	Excellent	Poor	Poor	Poor	Poor	Melts	Excellent
Low Temperature Characteristics @ −55°C	Very Flexible	Brittle	Flexible	Brittle	Brittle	Stiff	Stiff
Corona Resistance	Excellent	Poor	Fair	Good	Good	Fair	Poor
Radiation Resistance Ergs/gram	10^{10}	10^{10}	10^{9}	10^{10}	10^{10}	10^{10}	10^{7}
Flammability	Burns to non-conducting ash*	Burns	Burns	Burns	Self-Extinguishing	Burns	Self-Extinguishing

* Self-extinguishing silicone rubber compounds also available.

Get the full story on the economic and insulation advantages of General Electric silicone rubber. Write Section DD771, Silicone Products Dept., General Electric Company, Waterford, New York.

GENERAL ELECTRIC


3 circuits in only 3-37/64"
(Add 1-13/32" for each
complete block)
10 circuits in only 5-43/64"
(Add 13/16" for each complete block)
CHANNEL MOUNTING OPTIONAL
10 circuits in only 4-7/16"
(Add 21/32" for each complete block)

it's a snap . . .

WITH BUCHANAN SECTIONAL BLOCKS

Supplied in preassembled lengths . . . you snap-off the desired number of contact sections . . . add an end section . . . and your block is complete.

Buchanan blocks don't waste circuits. They reduce material and installation costs and save space. Three sizes cover from #22 through 250 MCM. Available in many contact and circuit identification types, flat base or channel mounted.

Buchanan blocks allow you to maintain a smaller inventory. You need only two parts for each size; this gives you increased production flexibility. Also, you have no loose contacts, bolts, washers, nuts or other miscellaneous hardware to worry about.

Buchanan blocks permit you to put more circuits in available space. Anchoring doesn't increase length or disrupt circuit spacing continuity. No space lost for intermediate mounting.

Buchanan blocks are completely covered in our new catalog B101. Write for your copy today. Learn all the reasons why so many users are turning to Buchanan... the best in blocks.

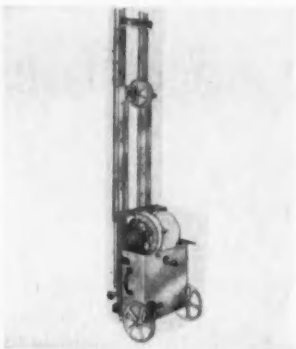
BUCHANAN
ELECTRICAL PRODUCTS CORPORATION
a subsidiary of ESNA
HILLSIDE, NEW JERSEY

See Us at Wescon Show Booth #205.

Pushbutton Stations (16)

An improved line of Neoprene-enclosed pendent pushbutton stations in 2-, 4- and 6-button sizes has been developed. Among the innovations in the new models are side mounted and expanded lengends; special Neoprene enclosure for operation at all ambient temperatures; and internal insulating barriers in the 4- and 6-button sizes for safety and rigidity. Bulletin B88 is available.

Joy Manufacturing Co., Electrical Products Div., Henry W. Oliver Bldg., Pittsburgh 22, Pa.



Cable Puller (17)

A new portable tool, called Junior Powercrat, is for pulling cable, hoisting pipe in shafts, winching in confined quarters. This portable equipment with two aluminum wheels can be wheeled on job like a handtruck and with lightweight boom structures adjustable horizontally and vertically. One man can set and operate it. Unit weighs 90 lbs, booms with adjustable sheave, axle and mounting brackets 35 lbs. Operates on 110 volts ac single phase service.

Modern Suppliers, Inc., 1090 Leggett Ave., New York 59, N. Y.

Baseboard Heating (18)

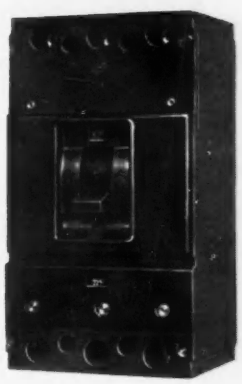
Two new lengths of baseboard electric heating have been added to this line of plug-together-type heaters. A 4-ft section, Model BB1.OD, is rated at 1000 watts and a 6-ft section, Model BB1.5D, produces 1500 watts of heating. They are available in 208, 240 and 277 volts as standard voltages. Thermal overload protection is standard equipment. Units are rated at 250 watts per foot.

Westinghouse Air Conditioning Div., P. O. Box 510, Staunton, Va.

Why Westinghouse is first in circuit breakers

In 1924 Westinghouse applied for the original patent on the trip-free mechanism for AB molded case circuit breakers

Since 1924 Westinghouse has continued improving the circuit breaker, with more improvements coming all the time



Since inventing the original AB molded case circuit breaker, Westinghouse has continued to earn scores of basic patents for circuit breaker developments. Each, in some way, has made today's Westinghouse circuit breaker a greater value. Present developments will make tomorrow's breaker even better.

These continued improvements have made Westinghouse AB De-Ion breakers the industry's most widely accepted breaker with designers, manufacturing engineers, contractors and others. Ask your local sales representative to show you how the full line of quality Westinghouse breakers can build more reliability into your electrical systems, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

J-90339

Westinghouse

BIDDLE INSTRUMENTS

IMPULSE CABLE FAULT LOCATING EQUIPMENT

• • • for locating faults on lead-covered cable installed in ducts—also on aerial and buried cable

• • • has proved highly effective in utility and industrial service

• • • transmitters provide d-c over-voltage test facility particularly suited to cables and other electrical apparatus in lower voltage classes

25kv set with detector

15kv or 5kv set

Three ratings available:
25kv • 15kv • 5kv

Each of the three models of Biddle Cable Fault Locators consists of a high voltage d-c impulse transmitter requiring only 600va input power at 115v, 60cps supply voltage for plug-in operation.

They are complete tracer current outfits in which high current at high voltage is used to break down the fault for external identification by means of a pickup coil and detector. The transmitters combine high power output with low energy input and with comparatively small size and weight.

Auxiliary equipment includes electromagnetic and audio detectors. A high voltage bridge for fault locating and loop resistance measurements is also available.

15kv and 5kv sets available with dolly for one-man operation

For information on all Biddle Cable Fault Locating equipment write for Bulletin 65-ECM.

8200

JAMES G. BIDDLE CO.

Electrical and Speed Measuring Instruments

1316 ARCH STREET • PHILADELPHIA 7, PENNSYLVANIA

Dimming System (19)

A system design approach to fluorescent dimming with all the system's control components supplied by one manufacturer has been announced. The new G-E dimming system for residential application affords smooth, reliable fluorescent dimming with a wide dimming range—a ratio of up to 300:1 between maximum and minimum intensity settings. Designated DS-3000 fluorescent dimming system, it can control two to nine F40 rapid-start lamps. Two or three DS-3000 systems may be mechanically ganged for a maximum of 27 lamps controlled from a single finger-tip dial.

General Electric Co., Schenectady 5, N. Y.

Floodlights (20)

Four redesigned floodlights — three general-purpose incandescents and a general-purpose mercury unit —have been introduced. They are FLA, MDB and MUA incandescents and MVF mercury model. The MDB general-purpose incandescent series has been redesigned and enlarged with the addition of a new 18-in. model. The series, also in 10-, 14- and 16-in. models, comes in 200,- 300-, 500-, 1000- and 1500-watt sizes. The new MUA Model IV 1500-watt is designed primarily for athletic fields, work and storage areas, parking lots and protective lighting applications. The MVF, 100-watt mercury floodlight, is especially suitable for crossarm mountings where rear relamping is desirable.

Crouse-Hinds Co., Syracuse, N. Y.

Fluid Drive (21)

A new fluid drive, which utilizes the natural shear resistance of silicone fluid to transfer power from input shaft to output shaft, has been introduced. Called the Visco-Torq, this drive provides automatic protection from shocks, stalls and jams for the driven equipment and overload protection for the motor. Drive is a traction-type coupling which uses silicone fluid shear resistance to transfer torque. It has a starting capacity of 170% of normal motor rating. Unit is available in nine sizes, from 1 to 20 hp, in two types—coupling and sheave. Folder 2748 is available.

Link-Belt Co., Prudential Plaza, Chicago 1, Ill.

Luminaires (22)

Several styles of interior fluorescent luminaires equipped with Pol-Rized polarizing panels are now available. They include the Triumph school-lighting luminaire, the Mark II Mainliner, the Cleer-vue and the Type SF. Polarized light improves color quality. It permits higher levels of light since there is a more even distribution of light. The polarizing panels are of a special plastic which has improved ultraviolet protection properties.

Westinghouse Lighting Div., Edgewater Park, Cleveland, Ohio

Ballast (23)

A new two-lamp constant wattage ballast for 96T12 or 72T12 800 ma rapid start lamps has been added to this line. Ballast features standardized mounting dimensions, 13¾ by 2. Also unit is lighter in weight by approximately 3 lbs per ballast. Dimensions are 14⅞ in. by 3¼ in. by 2¾ in.

Sola Electric Co., Elk Grove Village, Ill.

Boring Device (24)

Roto Witch, a new small-line boring attachment for Ditch Witch trenchers, has been announced. It is designed to bore trench beneath surface obstructions, such as paved streets, sidewalks, driveways, tracks, and planted areas. It bores holes up to 4 in. diameter up to 100 ft long (back reams up to 8 in. in diameter). Three bit options are offered: water circulation bit in areas of difficult penetration, auger bit and compaction bit. Roto Witch is available on M3 and M4 series Ditch Witch trenchers and may be field mounted on any of these machines.

Charles Machine Works, Inc., West Ditch Witch Road, Perry, Okla.

HOOK ON & MOVE ON

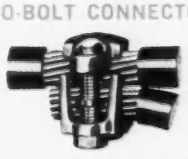
DURA-GRIP'S one-piece design installs without disassembly

(1) No loose pieces to handle . . . just open up, hook on to main, slip in tap wire and tighten. (2) DG's perform better electrically and mechanically. (3) DG's won't relax under torque. (4) DG's require no special tools – round edges facilitate fast taping. (5) DG's come in eight sizes which cover the complete range from 14 sol. to 4/0. (6) DG's are very compact high strength units with silicon bronze components. Want proof of Dura-Grip's superiority? Write Anderson Electric Corporation, Leeds, Alabama for complete details.

SOLD THRU AUTHORIZED DISTRIBUTORS

ANOTHER GOOD BUY! ANDERSON'S TYPE K TWO-BOLT CONNECTORS

• High strength bronze castings and hardware, Neoprene washers hold bolts captive and in position for easy thread engagement. No special tools required. Wire range — 8 sol. to 1000 MCM.



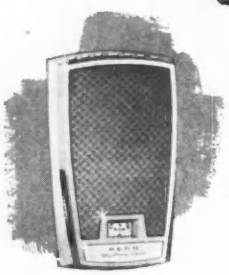
ANDERSON ELECTRIC CORPORATION

Research / Quality / Performance / in Aluminum and Bronze Products

*Trademark

WHY

electrically-heated homes need this humidity control



Penn "Click" Dial Electric Heat Thermostat

responds faster and holds temperature closely to selected level.

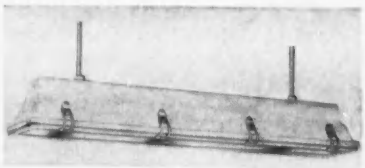
Well-insulated, electrically-heated homes tend to hold high levels of humidity. This condition causes condensation on windows, cold surfaces and possible penetration of moisture in insulation which may reduce insulating efficiency.

To solve these problems, and also assure more indoor comfort, more and more contractors are installing the Penn Type 844 to control the kitchen exhaust fan. Then, when humidity is excessive, the fan is started automatically to exhaust moisture-laden air thus reducing relative humidity. Use automatic humidity control as a selling feature for electric heat . . . your customers will appreciate the many advantages it gives them! Write the Penn factory for specific information.

PENN CONTROLS, INC.
General Offices: Goshen, Indiana

FACTORIES: GOSHEN, INDIANA • SYRACUSE, INDIANA • MILWAUKEE, WISCONSIN • WATERTOWN, WISCONSIN • COSTA MESA, CALIFORNIA • FOREST PARK, ILLINOIS • TORONTO, CANADA • AMSTERDAM, THE NETHERLANDS • BUENOS AIRES, ARGENTINA • TOKYO, JAPAN

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



Lighting Fixture (25)

New enclosed and gasketed (vaportight) fluorescent fixtures feature a one-piece steel body, rigidly formed and completely covered with vitreous porcelain enamel. Gaskets on body and frame effectively seal out fumes, vapors, dirt and moisture. Among new features are redesigned angle mounting brackets and easier wiring provisions. Bulletin is available.

Wheeler Reflector Co., Inc., Hanson, Mass.

Drilling Machine (26)

Model J Molco drilling machine is a concrete diamond core drilling machine designed for drilling holes in floors, walls or ceilings. Machine can be handled by one man to drill holes 1 in. in dia. to 6 in. dia. Special shaped vacuum bases hold machine firmly to work surface. Drilling can be done at rate of approximately 1 ft per minute through reinforced concrete. Machines can be supplied with either electrical or air motors.

Molco Drilling Machines Inc., 909 Franklin St., N.E., Washington, D. C.

Bracket (27)

A new messenger bracket for use with spacer type aerial cable. This bracket, Catalog No. MB-400, is of malleable iron, hot dip galvanized. It is designed specifically for use with the S&R continuous stringing system for stringing spacer type aerial cable. Bolt holes are on 8-in. centers, messenger is held 12 in. from face of pole. Available with three sizes of clamps for all messengers $\frac{1}{16}$ in. through $\frac{3}{8}$ in.

Sherman & Reilly, Inc., First and Broad Sts., Chattanooga 2, Tenn.

Conduit Fitting (28)

A new body line for rigid conduit, made of malleable iron, featuring smooth, burr-free throats, tapered hubs and extra wiring room, has been introduced. EMT bodies of the same basic design feature case hardened, cup pointed screws with shake

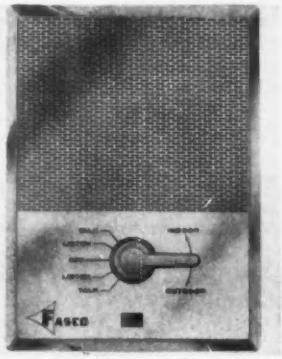
proof lockwashers and fully reamed hubs for alignment. Both groups are designed to provide extra space in the body and standard oval shape accommodates almost all covers. Both of the body groups are available in types C; LB; LL; LR and T in sizes from ½ in. through 2 in.

Gedney Electric Co., Radio City, New York 20, N. Y.

Transformers (29)

A new line of 3-phase transformers has been announced. Rated 750 kva through 1500 kva, 15 kv and below, transformers are designed for distribution systems. It affords better regulation, high short circuit strength, lower operating costs and represents a lower initial investment.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.



Intercom System (30)

"Round-the-clock" fire protection for the home owner has been combined with an indoor-outdoor intercom in a new system. Model 42 Detecto-Com, stays alert to fire danger, and at the same time guards the front door and carries two-way messages from room to room. Transistor amplifier is powered by the front door chime transformer. Fire watchers are inconspicuous, UL-listed fire detection thermostats spotted strategically around the house. Any abnormal rise in temperature instantly trips an alarm ahead on all intercom stations indoors and out. When door bell rings, door need not be opened. Callers talk into an outdoor remote station; are answered from any indoor station. All indoor stations can talk to each other and to remote stations outdoors. Unit measures 4 by 6 by 2 in.

Fasco Industries, Inc., Rochester 2, N. Y.

NOW!
5KV
3KV
HIGH VOLTAGE
PORTABLE CABLES WITH
HIGH NEOPRENE
CONTENT JACKET
CERTIFIED 67.32% NEOPRENE
AND BRONCO XL BUTYL INSULATION
BRONCO
Certified
66
NEOPRENE
Bronco Portable High Voltage Cables are built for continuous duty under the toughest, most rugged working conditions to which you can assign a portable electrical cable. They last longer because they are doubly protected. Unsurpassed external protection against oil, ozone, sunlight, abrasion, acids and alkalies is provided by the famous Bronco 66 jacket, a seamless sheath that is certified by a Registered Professional Engineer to contain not less than 67.32% neoprene —highest content in the industry. Internally, each conductor is insulated with Bronco XL Butyl, an advanced material with great inherent dielectric strength, with extraordinary resistance to high temperatures, corona, and aging. The assembled cable is Synchro-Cured, an exclusive Bronco process that provides the cable with a high degree of resilience. Bronco 66 Certified bounces back from extreme mechanical shock, stays on the job under crushing forces that defeat lesser cables. A big plus value is Bronco's patented (U. S. Patent 2867001) branding: complete identification is repeated at exact two-foot intervals on the jacket—vulcanized in so it can't be rubbed off. Bronco 66 Certified High Voltage Types W, G, and SH (shielded types A, B, C, and D) are now available to users through Electrical Wholesale Distributors. Write for a complete description of Portable High Voltage Bronco 66 Certified. Also ask for data on our duct and direct-burial high voltage items.
ELECTRICAL CONNECTORS
DESIGNED FOR WIRE BY A WIRE MANUFACTURER
bear the name
BRONCO GRIP
Selected from the extensive Bronco-Grip line of fittings and connectors, shown here is the Type F, high compression, Vise Grip Connector. Features: single bolt with full thread engagement, high re-usability, installed without disassembly, won't fall off line, full compression with any combination of conductor sizes, rounded contours for neat taping. Write for Bronco-Grip Catalog.
WESTERN INSULATED WIRE COMPANY
Los Angeles 58, California
BRONCO
BRED FOR STAMINA

The quality line with the built-in money-saving benefits

Rugged, durable, easy to maintain, installed for less — these are some of the many advantages engineered into Joy electrical connectors, push button stations and other equipment. Connectors and switches, for example, molded-to-cable in tough, resilient Neoprene, provide operator safety and resistance to impact, shock, vibration, corrosion and water penetration.

1. Switches, pendent or stationary, push-button types. 1, 2, 3, 4, 6, stations. Neoprene rubber enclosed. *Bulletin B82, B79.*

2. Power connectors for high voltages. Hypalon rubber encased, arc-safe, positive polarization. *Bulletin B81.*

3. Equipment control connectors. All-rubber molded-to-cable; 2 to 12 poles; water, air and dust tight. *Bulletin B72.*

4. Electric lifting magnet connectors. Shatter-proof, moisture-tight, distortion-resistant. *Bulletin B71.*

5. Watertight connectors for underwater service. All Neoprene, multi-pole, sealed against water penetration even at high pressures. *Bulletin B78.*

6. Low-voltage lights. Safe handlamp for lighting around grounded equipment, metal structures. *Bulletin F45.*

7. String-A-Light portable lighting assemblies. For industrial lighting, construction, derricks, mines, other multiple-lighting installations. Vaporproof, watertight. *Bulletin B52A, B66.*

8. Cable vulcanizers. Direct heat; bench or portable types. For repairing or splicing rubber, synthetics and plastic jacketed cable. *Bulletin B70A.*

9. Shatter-proof Neoprene bulb sockets. Dampen vibration, prolong filament life. *Bulletin B71.*

Send Today for the Bulletins you need.

CD 1251.1

JOY ELECTRICAL PRODUCTS DIVISION

ROOM 456
HENRY W. OLIVER BUILDING
PITTSBURGH 22, PENNSYLVANIA

Door Chimes (31)

Five new residential door chimes, each designed with a sealed chamber to enable entire housing to act as a resonator, have an exclusive separate mounting bracket. All electric chimes have two notes for front door signals and one note for rear or side door signals. A feature is its method of mounting. A mounting bracket is fastened in place before painting, and the entire sealed unit then slides into place on bracket later. Chimes have aluminum tone bars and flat, steel springs. Models operate from a 10-volt, 5-watt transformer or a 16-volt, 10-watt transformer.

Edwards Co., Inc., Norwalk, Conn.

Splicer (32)

A one-piece pre-insulated service entrance splicer, ⅝-in. dia., has been introduced. Accommodating any combination of aluminum, copper or ACSR conductor, the new splice can be installed with any standard ⅝-in. die. Fabricated of E.C. grade aluminum, splicer is covered with a weather-resistant extruded nylon insulation. Cover is color-coded to show wire size accommodations. An exclusive "poly-gland" provides a snug contact with conductor insulation. The ⅝-in. size covers No. 10 to 1/0 stranded conductor, No. 8 to 1 solid conductor and No. 6 to 1/0 ACSR.

Thomas & Betts Co., Inc., Elizabeth 1, N. J.

Plastic Tape (33)

An improved, polyethylene-based electrical tape has been produced through a new chemical process. Chemical cross-linking of polyethylene-based material to electrical insulating tape has increased tough-

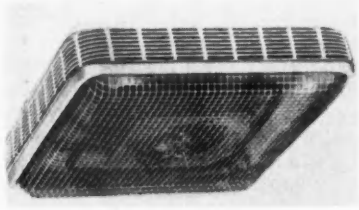
ness and raised operating temperature from 85°C to 90°C. This new development is an outgrowth of process changes to add greater tensile strength, to reduce cold flow and to increase resistance to abrasion. Every roll of BI-SEAL Type 2A electrical tape now manufactured is of the new formulation.

Bishop Mfg. Corp., 6 Canfield Rd., Cedar Grove, N. J.

Transformer (34)

A new 12-volt underwater-light transformer designed to reduce the possibility of electrical shock to swimmers as a result of faulty wiring or equipment has been introduced. Transformer has been designed to operate with 300-watt, 12-volt lamps. Three taps on unit are rated for 12, 13, and 14 volts to allow user to compensate voltage drops caused by using long lengths of wire between the transformer and the lamps. Full brightness provided by a 12-volt lamp may be maintained by moving to a higher voltage tap. Underwater light transformer may be adapted to any electrical system currently using line or 120 voltage. It is housed in a weatherproof box and may easily be mounted on a wall or a pole near a swimming pool. Once transformer is put into system, the 120-volt lamps must be replaced by low voltage, 12-volt lamps which meet recommendations of safety experts. Unit is listed by UL for use with submersible fixtures.

Transformer Dept., Sylvania Electric Products Inc., Estes St., Ipswich, Mass.



Ceiling Heater (35)

A new "Galaxy" ceiling heater features plug-in mounting. The 1250-watt units, measuring 10¾ in. by 10¾ in. by 2⅛ in., are available in either 120- or 240-volt models. Rough-in plate mounts to a standard 4 in. hexagon box in ceiling. Heating unit is then plugged in and fastened to rough-in plate by two small screws. A rod element is used.

Arvin Industries, Inc., Columbus, Ind.

Rugged Design...
Easy-to-Handle Balance

RIDGID®
HEAVY-DUTY
PIPE
CUTTERS

give faster, straighter cuts

Five Sizes for ⅛" to 6"

FACTORY TESTED

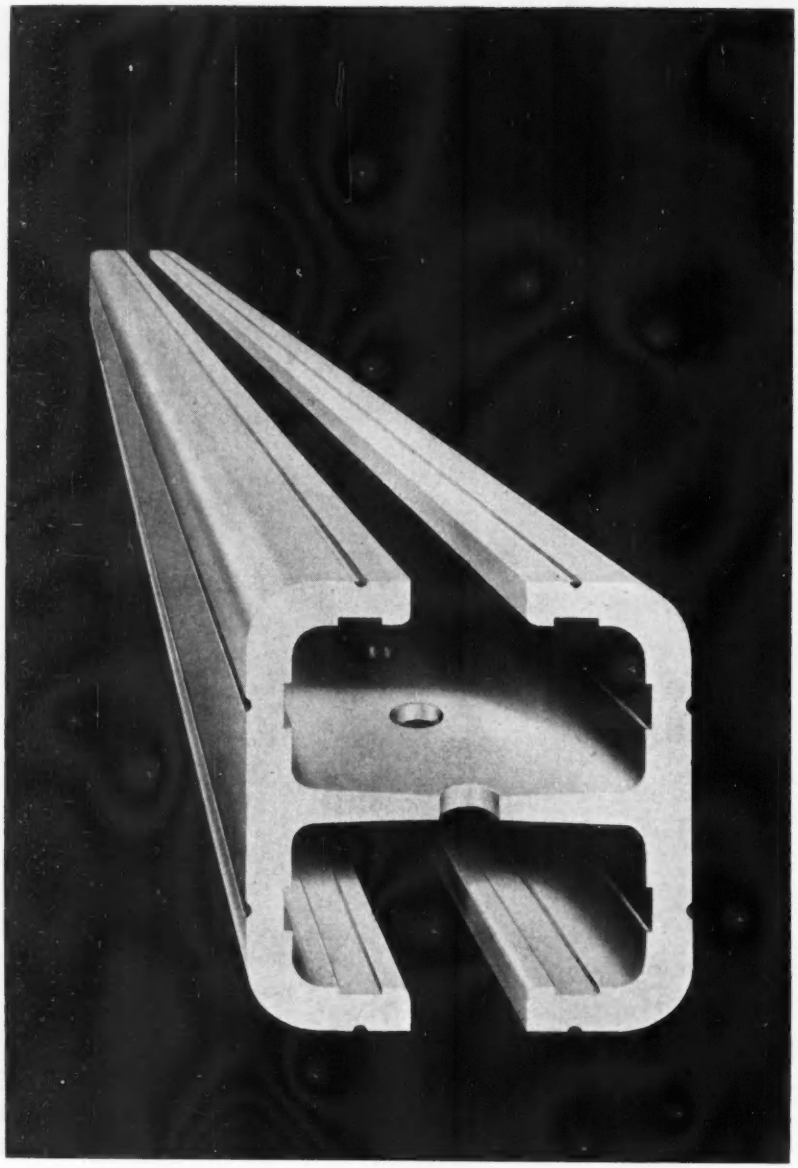
Pick up a RIDGID Heavy-Duty Pipe Cutter, and you'll instantly know why it makes pipe and conduit cutting far easier. Perfectly balanced . . . gives you a feel of confidence no other cutter can match. See the extra-long shank that protects handle threads . . . assures easy pressure application. Feel the large, smooth handle that gives you a comfortable, powerful grip. Try it, and you'll find a built-in cushion to keep the cutter wheel "on track" through hard or uneven spots. Rugged frame, guaranteed not to break or warp, stays straight for clean cuts every time.

You'll Want a RIDGID 4-Wheel Pipe Cutter for Work in Tight Places!

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and Parts!

RIDGID

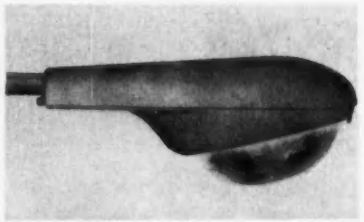
The Ridge Tool Company, Elyria, Ohio, U.S.A.



Look at the shape this conductor is in!

It's Alcoa "IWCB" (Integral Web Channel Bus) and it has a lot to offer! □ Web construction gives it high mechanical strength . . . able to withstand heavy fault current. Long unsupported runs are practical and economical. □ Joints, taps and splices are easier to make than on other types of bus. Note the flat surfaces and the grooves for automatic positioning of accessories. These features eliminate the need for expensive, bulky fittings and reduce on-site labor costs. □ Look into Alcoa IWCB when you're planning to modernize or expand. For full information on this or any other of the standard Alcoa aluminum bus shapes, call or write your Rome-Alcoa representative or Rome Cable Division of Alcoa, Dept. 7-72, Rome, N. Y.

ALCOA
ROME CABLE
DIVISION



Luminaire (36)

New horizontal burning mercury vapor luminaire, Style 15-000, uses an Alzak reflector which feeds a broad light beam to the Holophane refractor. Low glare 65° light angle is provided for, along with the more conventional 70° and 72° angles. Angle and light pattern are determined by easily changed socket position and lamp selection. Installation on either 1¼-in. or 2-in. mounting arms is provided by a reversible mounting bracket. Units are available in both 400- and 250-watt models, with or without built-in ballast and receptacle for individual photoelectric control.

American Electric Manufacturing Corp., 3271 Chelsea Ave., Memphis 8, Tenn.

Compensated OL Relay (37)

This motor overload relay is compensated for the effect of ambient temperature on its operation. Construction of the temperature sensing device includes two bimetallic, thermally activated helices — one for tripping and one for ambient compensation. When acted upon by ambient temperature, the two helices oppose and nullify each other. But only the tripping helix responds to motor overcurrent to open the circuit. The trip characteristics are adjustable and may be set for manual reset or automatic reset. This assembly prevents motor stopping due to high ambient temperature and prevents overload operation of motors in cold, unheated places.

Monitor Controller Div., Atlee Corp., 99 Grove St., Rockland, Mass.

Fitting (38)

A new type of flush service fitting for use with underfloor electrical raceway systems has been introduced. Service fitting bell cap is designed with removable tongue segment which allows cable and plug to be attached to receptacle or device before bell cap is installed and without first removing the male attachment plug and rewiring. Fittings are marketed with standard

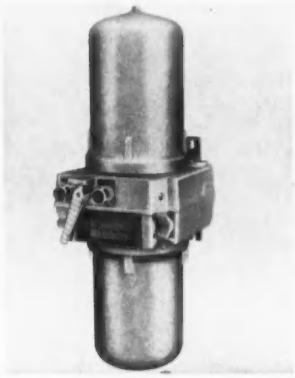
T-slot receptacle or NEMA grounded receptacle for power circuits. Fittings for use on signal or telephone circuits are supplied without wiring device. When installed, bell cap threads securely into service fitting flanged housing and stands 2⅛ in. from floor surface to top. One-piece flanged housing has a threaded base for positive screw-threading into any standard 2-in. dia. underfloor duct outlet.

Wheatland Electric Products Co., Carnegie, Pa.

Lampholder (39)

A new porcelain ceiling lampholder with pull chain switch and a side grounding outlet is now available. Large diameter base of lampholder conceals broken plaster and can be wired without disassembling. Socket has a screw shell construction with a spring brass center contact. Lampholder is 4½ in. in dia and 2½ in. high and fits 3¼-in. to 4-in. boxes. It comes with a 30-in. pull cord and mounting screws. It has a lamp socket rating of 250 watts, 125 volts, and an outlet rating of 15 amps, 125 volts.

General Electric Co., Providence, R. I.



Voltage Starters (40)

A broad line of reduced voltage starters, mounted in Spin Top explosion-proof enclosures, is now available. These are air-break devices for use in Class I, Groups C and D, and Class II, Groups E, F and G hazardous locations. Intended for any application where power or load limitations require starting motors on reduced voltage, starters are offered in autotransformers, star-delta and part-winding types. Enclosure features fully-protected Acme threads, easy slide-and-hook mounting and recessed control stations.

Square D Co., 4041 North Richards St., Milwaukee 12, Wis.

RIDGID®

65R-TC

RATCHET THREADER

with new True-Centering Workholder

Gives Better Threads Faster 4 Ways!

Here's Why:
One set of dies threads 1", 1¼", 1½" and 2" pipe and conduit . . . no dies to change. • Fast-to-set, True-Centering Workholder centers dies for true threads every time • Easy adjustment for accurate "drip" threads • It's jam-proof . . . automatic kick-out —prevents jamming.

RIDGID 65-RC with Cam-Type Workholder Also Available.

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Find a control job this can't do!

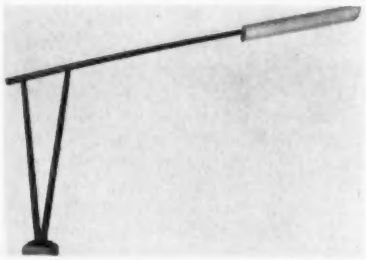
There aren't many. This dependable photoelectric unit and others in General Electric's full line can control an almost endless number of jobs. And they do it so efficiently that you'll save money by using photoelectric control.

A new 24-page catalog by General Electric, "Photoelectric Control," can help you learn more about these modern control devices—many brand new. The catalog shows how photoelectric systems work. It suggests applications: sorting, alarming, detecting, counting, sensing, protecting . . . and many others. Also, it has complete information—including prices—on General Electric photoelectric equipment and systems.

For your copy, write for bulletin GEA-6822, Section 793-8, General Electric Co., Schenectady, N.Y. After reading it, try to find a control job photoelectric units can't do for you.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Floodlight Pole (41)

New Series 540 Cantilever Pole designed for Series 9900 fluorescent floodlight is available. Series 9900 luminaire features completely luminous wrap-around design and is positioned at a 15° angle. It is mounted by means of a 28-in. length of 2-in. extra-heavy steel pipe welded to the cantilever beam of the pole. This pipe forms a mounting stub which fits inside the steel reinforcing structure of the luminaire. The pole is offered in two mounting heights: 14 ft-6 in. and 17 ft-6 in. Bulletin 900-16D is available.

Revere Electric Mfg. Co., 7420 *Lehigh Ave., Chicago* 48, *Ill.*

Switch (42)

New duplex ac quiet switch with neon pilot or night light has been added to this line. Duplex combination device is molded of brown phenolic or ivory thermosetting plastic with heavy gauge, rustproof underslung steel strap. Switch is rated 15 amps, 120 volts, ac only; pilot light rated at 1/25 watt, 125 volts. It is listed by UL.

Leviton Manufacturing Co., Inc., 236 *Greenpoint Ave., Brooklyn* 22, *N. Y.*

Ceiling Support System (43)

A ceiling support system, utilizing new flanged channel P-6000F and special hangar fittings, has been introduced. Acoustical or translucent panels up to 4 ft wide and of any length can be laid-in on the support channels. Ceiling air diffusers, troffer and panel type lighting units can be placed upon the channel flanges with ample support. The Unistrut ceiling support system is applicable for new construction as well as for modernization work. System can be used in grid or linear patterns or in special applications such as individual luminaire panels. The ceiling framing channel can be suspended by wire or chain, by continuous threaded

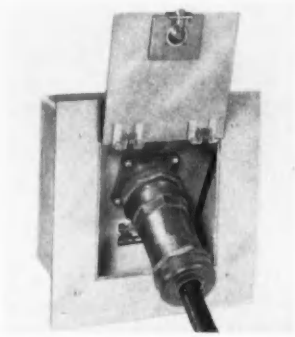
Unirod, or interlocking channels. Duct-work and electric wiring can be housed in the air space between building joists and dropped ceiling. Literature is available.

Unistrut Products Co., 1015 W. Washington Blvd., Chicago 7, Ill.

Cover Control Conversion (44)

New cover control and three-coil overload conversion kits simplify the installation and maintenance of ac magnetic starters. Cover control kits, available for field converting "reset only" starters to either "start, stop-reset" or 3-position selector switch with "reset" cover control combinations, are applicable on NEMA Type 1 general purpose enclosures for each of seven NEMA controller Sizes 00 through 5, fractional to 200 hp. Three-coil conversion kits allow starters equipped with the new two-coil relay to be quickly field-converted to a three-coil arrangement.

Cutler-Hammer Inc., 315 North 12th St., Milwaukee, Wis.



Outlet Receptacle (45)

A new Ark-trol X-ray electrical outlet receptacle in a narrower 4-in. deep wall-mounting box is specifically designed for installation above the 5-ft level in hospital partitions too narrow to hold normally deeper housings. Unit is for use in hospital operating rooms, laboratories, and other locations requiring a power source for portable X-ray equipment. The plug and receptacle have a power rating of 600 volts ac and 250 volts dc. The sheet metal wall box for receptacle, designed for flush wall mounting, is 8 in. sq and equipped with a stainless steel cover plate and hinged door. Receptacle is mounted at a downward angle and is equipped with three No. 4 leads to facilitate wiring.

Crouse-Hinds Co., Syracuse, N. Y.

World's Fastest, Smoothest Hand Reaming

1/8" to 2" Capacity

Self-Feeding RIDGID No. 2-S Spiral Reamer

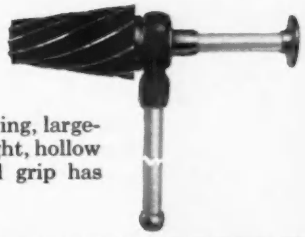
... reams pipe, conduit, sheet metal and wood!

Try a RIDGID Spiral Reamer, and you'll quickly feel how it reams its way into pipe, conduit, metal holes or wood without effort. Heat-treated cutting edges give maximum service life. Ratchet-action handle makes work easy in close quarters.

Now Available ...

RIDGID No. 254 Spiral Reamer

for 2½" to 4" Pipe and Conduit



No more hand filing ... here's the time-saving, large-size hand reamer you've always needed. Light, hollow construction makes handling easy. Hand grip has large butt plate for body pressure.

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

SUPER

Twist-Lock®

MOTOR PLUG BASES

NO. 3434

LEFT: No. 3434 Super "Twist-Lock" 4- wire male motor plug base for 30 amperes, 250 volts AC-DC, or 30 amperes, 600 volts AC.

BELOW: Yellow represents cross-section of standard sized 20 ampere, 4-wire male motor plug base for 250 volts AC-DC, or 10 amperes, 600 volts AC. Note how much smaller No. 3434 Super "Twist-Lock" unit is, even though rated 10 amperes greater.

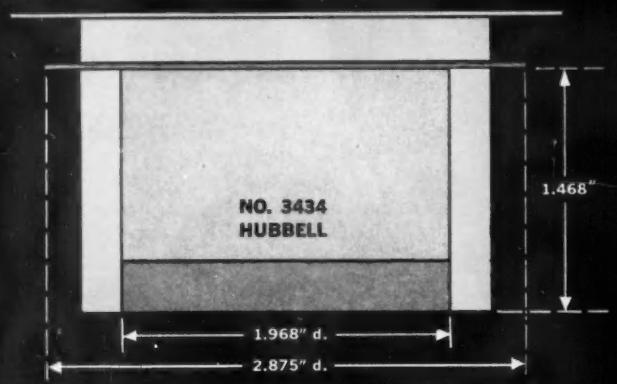


DIAGRAM ACTUAL SIZE
YELLOW IS STANDARD SIZE;
SUPERIMPOSED IS SUPER "TWIST-LOCK" SIZE

UL

NOW—MOTOR PLUG BASES IN SPACE-SAVING DIMENSIONS

Super "Twist-Lock" Devices Handle Higher Amperages in Less Space

When a matching connector is plugged into a Super "Twist-Lock" motor plug base, a clockwise twist locks it against accidental disconnection. Deadfront construction seals out dust, lint, metal chips, etc.

Super "Twist-Lock" devices are much more compact and lighter in weight than standard models. Designers of machines and power tools specify them because they gang closely and reduce wiring time.

Super "Twist-Lock" male or female motor plug bases in polarized grounding or ungrounded models are available in 10-, 20-, and 30-ampere ratings for 2-, 3-, 4-, or 5-wire circuits.

Super "Twist-Lock" motor bases, cord caps, connector bodies, and receptacles are described in our Catalog No. 29. Or write for 24-page brochure H-1425 on the "Twist-Lock" line.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

HARVEY
HUBBELL
INCORPORATED
Bridgeport 2 Connecticut

®"Twist-Lock" is a registered trademark of Harvey Hubbell, Incorporated

Catalogs & Bulletins

(46) DC MILL MOTORS. Bulletin GEA-6775 describes repair procedures followed at GE Service Shops during the remanufacture of dc rotating equipment. General Electric Co.

(47) FLOODLIGHT. 4-page folder describes type INA-10 controlled rectangular beam floodlight. Infranor of North America, Inc.

(48) SCHOOL LIGHTING guide with tips on economical maintenance is subject of new 16-page booklet (A.I.A. File No. 31F2). Wakefield Art Metal Lighting Div., Wakefield Corp.

(49) LIGHTING. 4-page catalog illustrates and describes new line of incandescent lamps. Swing Lamp Corp.

(50) WOUND ROTOR MOTORS. New engineering brochure gives data on the application of wound rotor motors to machines used in a wide cross section of industry—materials handling, air conditioning, printing, elevators, pumps, compressors, blowers and special machinery. Reuland Electric Co.

(51) TIME CONTROLS. Form No. 6118-A, 12-page pocket-sized brochure, describes specific advantages of a time switch or timer, typical time control problems and the time controls available for the application. Paragon Electric Co., Inc.

(52) ELECTRIC SPACE HEATERS. Folder describes the applications and cost of infrared electric space-heaters available with specifications and installation procedure for each individual heating units. Fannon Products Div., Hupp Corp.

(53) INSULATION TESTERS (megohmmeters) are described in Bulletin 456 including their new CD series and the new dual voltage "standard" megohmers. Herman H. Sticht Co., Inc.

(54) FITTINGS. Catalog 51 describes threadless boxes, accessories, special threadless fittings including couplings, connectors, reducers and attachments, round series and flush switch series threadless boxes. Kondu Corp.

(55) FLUORESCENT LAMP BALLASTS. 16-page catalog describes line of fluorescent lamp ballasts for interior and outdoor fixture installation, residential, commercial and industrial use. Jefferson Electric Co.

(56) SCHOOL LIGHTING. 16-page publication covers all aspects of school lighting: need, benefits, economics, techniques, quantity, quality and lamps. General Electric Co., Large Lamp Dept.

(57) PARKING AREA LIGHTING specifications are explained in a portfolio of four brochures. A choice of three lighting unit types, incandescent, mercury vapor and fluorescent is offered. Steber Div., Pyle-National Co.

(58) ELECTRICAL ENCLOSURES, including hinged and screw cover pull boxes and wireways, telephone and transformer cabinets, are described in 20-page brochure. Columbia Metal Products Co.

(59) FLUORESCENT BALLASTS. 16-page Bulletin GEA-7325 entitled "What You Need to Know About Fluorescent Ballasts" contains basic information on the operation of different types of ballasts and their proper installation in fluorescent lighting systems. General Electric Co.

(60) MOTORS. Standard fractional hp motors which are normally carried in stock are listed in revised 6-page Bulletin 2820. Westinghouse Electric Corp., Industrial Motor Dept.

(61) NURSES' CALL SYSTEM. 4-page System Data Sheet HS-1 describes visual nurses' call systems and aids in selection of equipment and system planning. S. H. Couch Co., Inc.

(62) ELECTRICAL PRODUCTS. 930-page indexed catalog gives complete specifications and installation data on products of the company's Unilet, Reelite, roughing-in, lighting, foundry and malleable iron divisions. Appleton Electric Co.

(63) LUMINAIRES. 8-page Booklet B-8254 describes a new mercury streetlighting luminaire called the OV-12. Westinghouse Electric Corp., Lighting Div.

(64) APARTMENT PHONE SYSTEM. A cordless type transistorized telephone system with phones either in vestibules, suites or both is described in 4-page System Data Sheet TS 71B. S. H. Couch Co., Inc.

(65) CONTROL. Bulletin E-300 describes redesigned "Sen-Tek" detector control, infrared type. Euclid Electric & Mfg. Co.

(66) TIME SWITCH. Bulletin describes new photocell clock controlled time switches. Sangamo Electric Co.

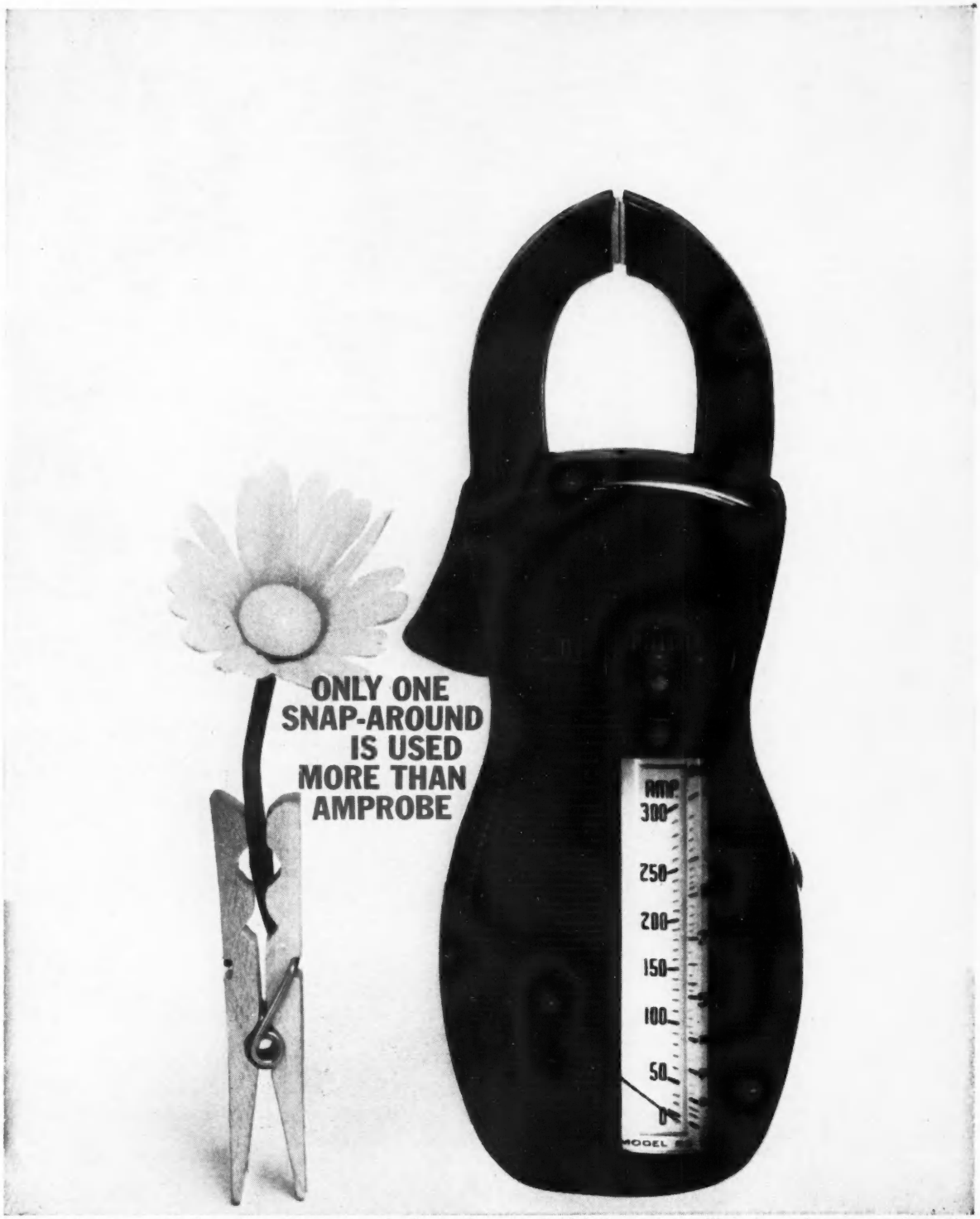
IMITATED
...BUT
NEVER
EQUALLED

CHAN NEL LOCK®

When you buy a Channellock, you get two exclusive patented features you can't get in any other adjustable plier:

1. Smooth-working, machined, undercut channels. The tighter you grip, the tighter they lock.
2. Reinforcing rib for added strength when you put the muscle to a job.

Only Channellock—the original tongue and groove plier—has these features. *Be sure you're getting the* **genuine** *Channellock . . . look for the trademark on the handle.* Your choice of five jaw capacities: ½, ⅞, 1½, 2 and 2¼ inches. Write for catalog showing our complete line of pliers. Champion DeArment Tool Company, Meadville, Pennsylvania.



You can't hang wet wash with an Amprobe snap-around volt-amp-ohmmeter, but it is the most versatile instrument you can use for testing electrical equipment. Use the RS-3, for example, as a voltmeter to determine high- or low-voltage conditions (3 ranges: 0-150/300/600 v AC); as an ammeter to balance circuits, set relays, take load surveys (5 ranges: 0-5/15/40/100/300 amps AC); and as an ohmmeter to measure resistance and check for continuity, opens and shorts (1 range: 25 ohms mid-scale). All this with a sturdy, lightweight tool that's as easy to use as a clothespin. The RS-3's rotary scale ensures error-free readings; its pointer lock enables you to work with either hand — even when conductors are hard to get at. No wonder more Amprobes are in use today than all other similar instruments combined. Pick from 21 different models. The RS-3 sells for $52.50. Other Amprobes start at $19.85. At your distributor.

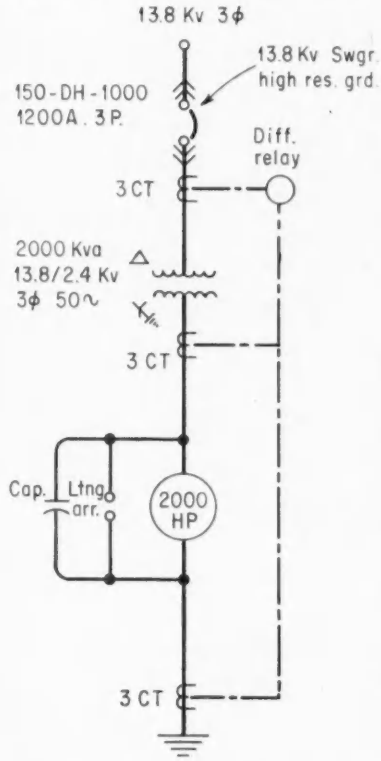
AMPROBE INSTRUMENT CORPORATION
630 MERRICK ROAD, LYNBROOK, NEW YORK
IN CANADA: ATLAS RADIO CORP., 50 WINGOLD AVE., TORONTO

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Protecting High-Voltage Motors

QUESTION E41 — A low-impedance power transformer is used to furnish power for a 2000-hp induction motor as shown in sketch below. A question has been raised as



to whether the neutral leads of the wye connected motor should or should not be grounded if the differential overcurrent relay is to operate properly.—V.M.M.

ANSWER TO E41 — Well-established grounding practices would leave the motor ungrounded. Where differential relaying is to be applied to a machine the system should be grounded at the supply transformer through a resistor such that the full-voltage line-to-ground fault current will approximately equal the rating of the current transformers used for differential relays. Therefore, in this case, the 2000-kva transformer secondary neutral should be grounded through a resistor and the motor should not be grounded. Grounding as indicated will provide sufficient difference current through the differential relay CT's to detect a ground fault within a few percent of the winding from neutral.

Solid system grounding should be avoided as it results in excessive ground fault current conducive to iron burning at the point of fault in the machine. However, it is also imperative that the system not be left ungrounded as ungrounded systems are subject to transient overvoltages that are injurious to the motor and system insulation.

Where one transformer is devoted to serving one motor, as in this case, a preferable approach to ground-fault protection is to provide a high-resistance ground and a relay in the transformer neutral. The purpose of this high-resistance ground would be to control transient overvoltages and provide sufficient current for the neutral relay. Such a relay can be selected to provide fast, sensitive ground-fault protection with a minimum of damage at the fault point. This method is so effective that some experienced protection people prefer it to differential relaying.—G.W.W.

ANSWER TO E41—A differential or balanced overcurrent relay operates on the principle that the current in the three sets of three current transformers are balanced. Any unbalance will actuate the relay and trip the breaker.

You will find that induction motors are not generally available with neutral leads brought out for grounding purposes; therefore, the answer to your question is NO.

However, always consult with the motor manufacturer, especially in cases where the motor is of the 2000-hp size.—J.A.M.

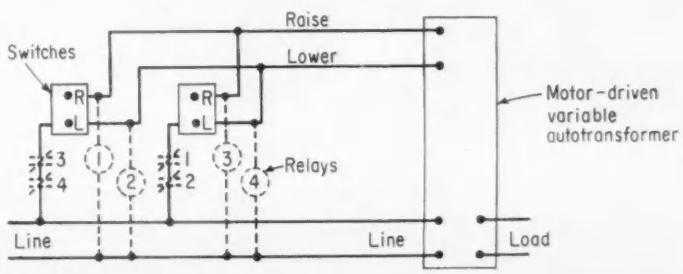
Multiple-Control for Dimmers

QUESTION F41—We are planning a dimmer control for our auditorium lights. The total load will be approximately 20 kw. We need two remote-control rheostats, one on the stage, and one at the rear door. These controls should work independently, i.e., either should completely and independently control the lights (similar to 3-way switches with variable light control). We have been told that this type control is not available.

With the present state of electrical development, this is difficult to believe. Where can such control be purchased or what can we do to make this ourselves?—J.A.M.

ANSWER TO F41—Your problem is easily solved with motor-driven light-control units—variable autotransformers. These are available in standard units in the range of 1000 to 30,000 watts. Control is by a raise-lower switch (momentary contact) of either the lever or push-button type. Control can be accomplished from several locations as shown in the sketch below. If the switches are located out of sight from each other, it might be desirable to use relays to permit only one switch to be used at a time.—J.H.K.

ANSWER TO F41—I would suggest you use a motor-driven dimmer with remote control stations. These stations can be multiple and of a low-voltage type, consisting of forward and reverse momentary-contact switches or pushbuttons, which will actuate a relay to drive the central motor to an increase or decrease.



ADD 2¼ PLACE MARK AT B FOR BACK TO BACK BENDS
A
B
1
2
3
4
5
6
2
RUNIT

THE BEST INSTALLED COSTS LESS

QUICK AND EASY

Exclusive bending system for Republic ELECTRUNITE® saves you time and trouble

Easy does it! An exclusive system for bending ELECTRUNITE Electrical Metallic Tubing assures faster, more profitable installations. The system consists of:

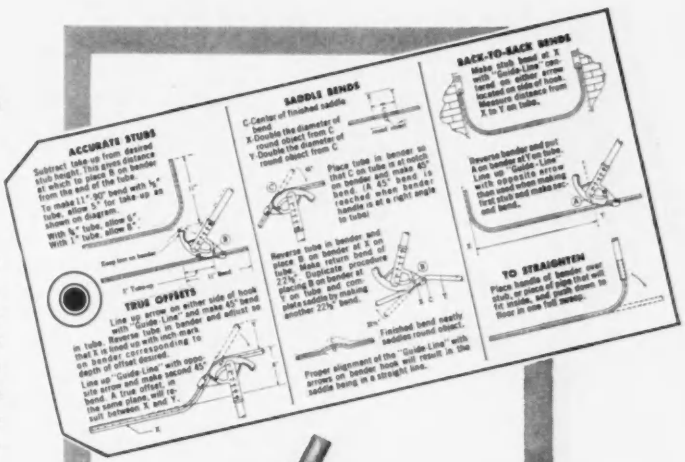
"INCH-MARKS"—The tube is pre-marked in feet and inches. Run your hand down the tube to the proper mark, place the bender in position, and you're set to bend. You save 30 seconds or more per measurement. Make stubs and back-to-back bends without time-consuming trial and error fittings.

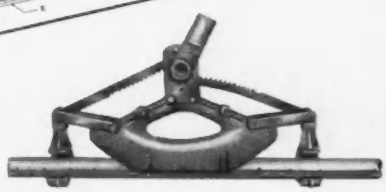
"GUIDE-LINE®"—Dark blue line runs the full length of the tube, helps you keep bends in the correct plane. Used in conjunction with Republic Benders, this line helps eliminate time spent pushing "wows" into line . . . time spent straightening and rebending tubing.

THE FAMOUS REPUBLIC BENDER—Developed for use with ELECTRUNITE E.M.T., this bender works in conjunction with the "INCH-MARKS" and "GUIDE LINE", makes it easy to produce exact, predetermined bends of uniform radius.

BENDING INSTRUCTION TAG—Supplied with each shipment of tubing, the tag contains condensed instructions for standard bends. One side of this tag is seen at right.

ELECTRUNITE E.M.T. fits the bender and bends evenly. If bent too far, it straightens out smoothly. Troublesome hard spots in the tube are eliminated by the use of prime steel, made and quality controlled in Republic's own mills. Mail the coupon for a copy of Republic's booklet, *The Bending System for ELECTRUNITE E.M.T.*





Republic's No. 2475 Bender has all the necessary measuring marks to make up to 90° bends in both 1¼″ E.M.T. and 1″ Rigid Steel Conduit.

Compatibility and strength charactarize raceways made of

Galvanized Steel

REPUBLIC STEEL

Cleveland 1, Ohio

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • DEPT. A-4706
212 EAST 131st STREET • CLEVELAND 8, OHIO

Please send a copy of the booklet:
The Bending System for ELECTRUNITE E.M.T.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

need a

TIMER

to reduce operating costs by automating:

SEWAGE TREATMENT • CHEMICAL FEED
ACCESS PURGING • MACHINE TOOLING
WATER SOFTENING • AREA SPRINKLING
TRAFFIC SIGNALS • BATTERY CHARGING
SEWAGE AERATION • MOTOR CONTROL
HEAT TREATING • LIFE TESTING
LUBRICATION • IRRIGATION
WATER PUMP TIMING
GREENHOUSE MISTING
AIR CONDITIONING
PROCESS TIMING
VENTILATING
CONVEYORS
HEATING
MIXING

516 Series 500 Series

2900 Series JW Series CR Series 1015 Series

PARAGON

makes it!

No matter what the application, you can rely on high quality Paragon Time Controls to automatically control the "ON-OFF" operations.

For complete specifications and application data **contact your Authorized Paragon Distributor.** He carries a full line in stock and is qualified to provide technical assistance if needed.

Call for Paragon on *your* next order.

PARAGON WHOLESALE POLICY
We sell Paragon Time Controls to dealers, contractors and industrial end users ONLY through our established Wholesalers. Paragon does not depart, under any circumstances, from this policy — firmly held for more than 50 years.

27704

AMF | PARAGON ELECTRIC CO., INC.
Subsidiary of American Machine & Foundry Company
1614 TWELFTH STREET • TWO RIVERS, WISCONSIN

Time is money... control it with Paragon

With this method you need only purchase one dimmer control unit, having a greater flexibility of remote stations and using inexpensive low-voltage wiring devices. Your dimmer control unit can be located at a desirable place near your load center for easy maintenance, and also the length of load conductors can be shortened.

You did not specify the type of illumination, incandescent or ballast-type fluorescent. This would make a difference in the type of dimmer control needed.—A.J.F.

ANSWER TO F41—Since the rheostat to control 20 kw would be a motorized type, J.A.M. does not need two remote-control rheostats but two remote rheostat controls.

I would feed the rheostat motor through a forward-reverse magnetic relay. The magnetic relay would, in turn, be controlled by two pushbutton stations at the locations mentioned. These stations would be wired in parallel, without holding circuits (job-button fashion), three-wire. Each station would be able to raise or lower the lights by holding in one or the other button to desired lighting level.—J.A.P.

ANSWER TO F41—I assume you want to control one circuit of approximately 20 kw of auditorium main lighting, from the stage and at the rear door of the auditorium. In planning a new auditorium you should not overlook stage lighting dimming facilities. For best results you should have *at least* four stage-lighting circuits so that you could use colored lighting for special effects. These circuits should all be independently controlled from at least three locations. The most desirable location would be at the speakers podium, in the projection room, and backstage near the stage curtains.

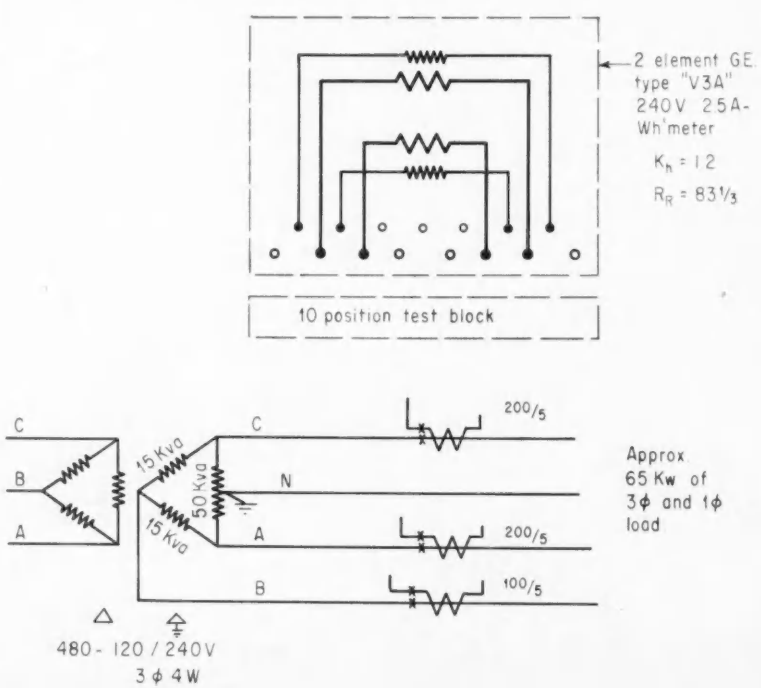
For all of your circuits you could use motor-driven rheostats as manufactured by the Hub Electric Co., but you could also use motor driven autotransformers. Both systems will permit operation from any number of positions.

The Standard Electric Products Co., Dayton, Ohio, offers an "Adjust-A-Volt" unit, and the Superior Electric Co., offers a motor-driven Powerstat. You should be able to get these remote-controlled variable auto-transformers for all voltages and power ratings required for auditorium lighting.—H.E.H.

Can You Answer These QUESTIONS?

QUESTION P41—Can you help me out on a WH-meter installation? What is the correct connection diagram? How accurate will the WH-meter show the true load?

This system was working before but by moving the bank, I got confused as to how to connect the current transformers and the meter. See sketch below.—A.C.



WHEN YOU'RE WIRING FOR SOUND

BE SURE IT'S WITH CORNISH

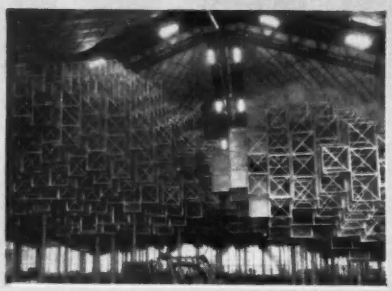
When you're installing sound and communications systems, radio or TV hook-ups—count on Cornish to furnish the wire and cable you need. At Cornish you'll find complete selections of shielded and unshielded, single and multipair intercom, sound and coaxial cables. They are available in many required conductor sizes, a wide variety of insulations and jackets, made to the tightest specifications. ☐ See Cornish, too, for the really complete lines of heavy-duty extensions, cord sets, flexible cords and portable Power-Lite lines. Distributors are everywhere—coast to coast. Cornish Wire Company, 50 Church Street, New York 7, New York.

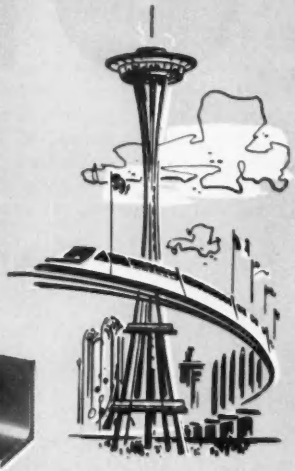
CORNISH

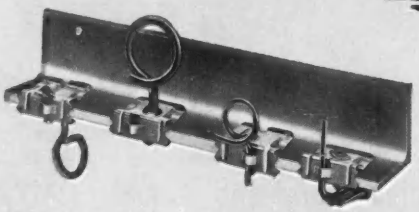
a division of General Cable Corporation

GAT.
-a Lifesaver!

Photo courtesy Mr. Floyd Johnson, electrician, Van S. McKenny Company, Inc.







The Van S. McKenny Company, Inc., 104 Wall Street, Seattle 1, Washington recently installed hundreds of aluminum cubicles mounted on steel pedestals for the State of Washington, Coliseum Building at the Century 21 Exposition.

As stated by Mr. Ralph C. Moreau of Van S. McKenny Company: "We wish to advise you that the GAT B-Beam Clip with bridle rings was a "lifesaver" on the above mentioned job, inasmuch as the architect would not permit us to drill any of the cubes to support our cables.

"We heartily recommend this device for speed and sound construction application, and if we should ever have occasion for a similar construction as the above job, we certainly would employ the same type of fasteners."

GAT. FASTENER Div. | ERICO PRODUCTS, INC. 2070 EAST 61st PLACE • CLEVELAND 3, OHIO

ON THE BALL is Harry Johnson, owner of Russett Lanes in Shelley, Idaho, who directed Scott Williams of Solar Electric Heat and Insulating Co., St. Anthony, Idaho, (seen kibitzing) to go "completely electric" in designing this modern bowling center. As a result, electric facilities include heating, air conditioning, hot water heating, cooking, lighting, intercom and public-address systems, pin-spotting and ball returns; all wiring and controls are being installed by Solar.

QUESTION Q41—How many 400-watt mercury-vapor bulbs can be controlled by a 40-amp double-pole time clock?—H.S.

QUESTION R41—A sawmill consisting of several scattered buildings has a 440-volt 3-wire, 3-phase ungrounded overhead distribution system originating from a 750-kva platform-mounted transformer station, centrally located between the various buildings. There are no fuses or breakers in either the primary or secondary side of the overhead wiring on the sawmill premises. The electric utility has fused drop-outs in the primary two spans away from the transformers at the property line where it is tapped to a shielded feeder. Each building has standard 440-volt fused disconnect service equipment at the termination of each service drop.

As a result of a number of claims of lightning damaged motors, the insurance company has suggested the installation of lightning arresters at the service head of each building, one arrester per phase wire connected to a driven ground rod. Ground resistances of such electrodes in this vicinity run in the order of 50 to 300 ohms. There is no common underground water piping system on the premises.

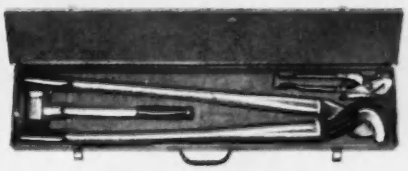
Will arresters installed under the above conditions be of any practical value, and if not, what would you recommend?—R.B.F.

PLEASE SEND IN YOUR ANSWERS BY AUGUST 15

Kids Prefer Dads . . .

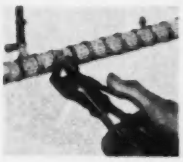
Who stay young with T&B products . . . who come home with a spring in their step and ready for fun.

We really can't promise that T&B products will make you a kid again . . . But you'll feel better in all ways when you see how tough jobs can be made easier. Here are a few of our products that will add extra quality to wire handling and send you home with a smile.



CABLE INSTALLATION KIT

Everything for bending — slicing — stripping cable. Bend cable up to 750 MCM, slice cable to 1,000 MCM and strip cable from #1 to 1,000 MCM.



TY-RAP™ CABLE TIES AND STRAPS

Six times faster than tying with string — low cost installation can be done by tool or hand. Wide range of TY-RAPS for tying, clamping, mounting and identification.

STA-KON® TERMINALS

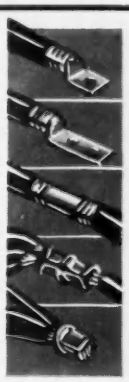
Industry's most complete line of insulated and non-insulated terminals #26 — 250 MCM. Ring tongue, forked tongue, wire joints, splices, disconnects and flag.

WT100M installs #22 — #10 wire range.

COLOR-KEYED® LINE

LUGS, TAPS, JOINTS AND CONNECTORS color-keyed for instant selection by wire size. One tool installs the whole range #8 AWG through 500 MCM.

Exclusive T&B compression method insures permanent, low-resistance connections.



On your next "wire handling" requirement check with one of our authorized distributors in your area — he'll have what you need to do the job right.

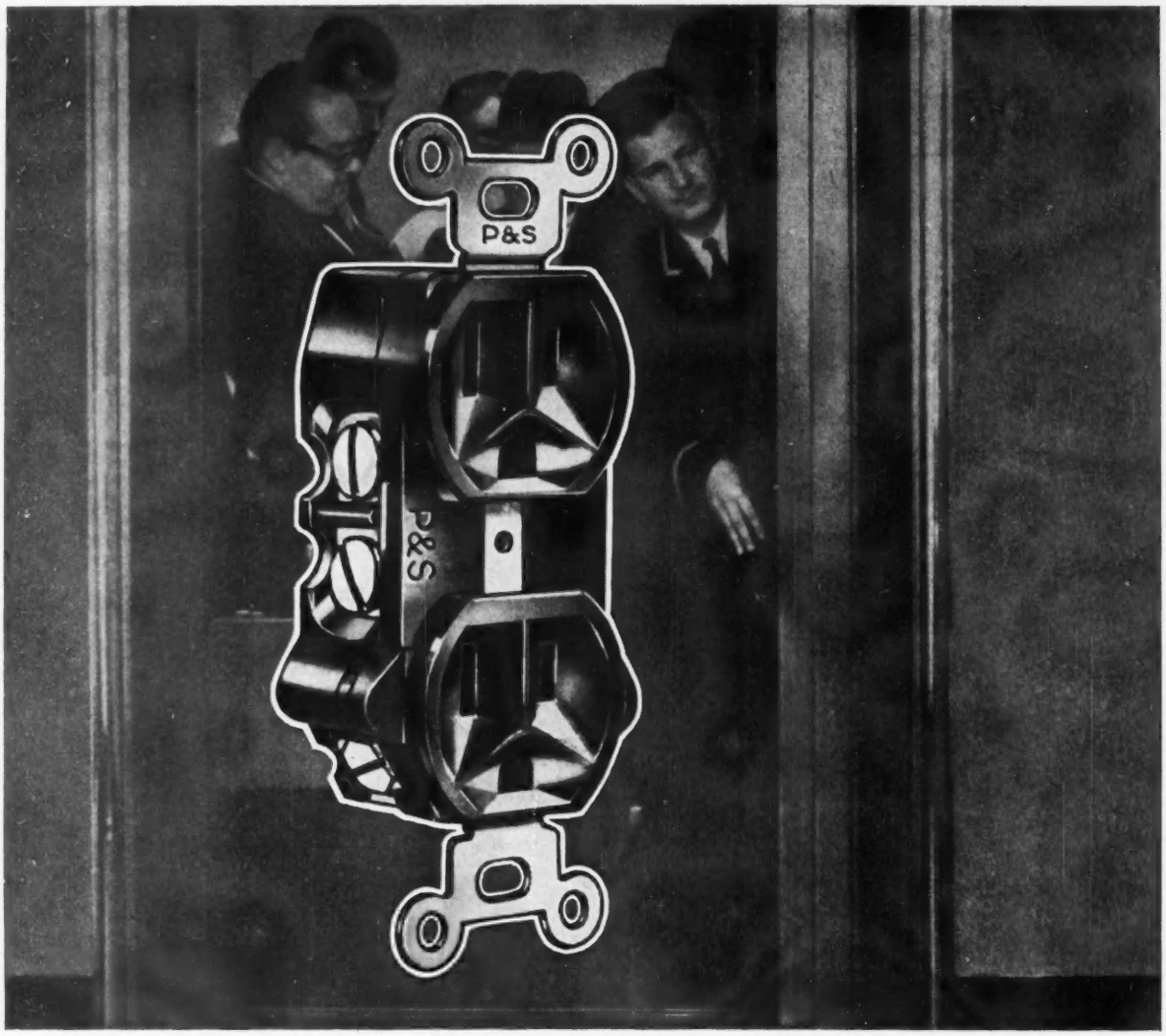
Write for our complete catalog of electrical construction products.

SOLD COAST-TO-COAST THROUGH AUTHORIZED T&B DISTRIBUTORS

T&B ENGINEERED

THOMAS & BETTS

The Thomas & Betts Co., Incorporated • Elizabeth, New Jersey
In Canada, Thomas & Betts Ltd. • Montreal



FROM THE GROUND UP

PROFESSIONALS SPECIFY SAFETY

PROVEN, DEPENDABLE & VERSATILE

...P&S 5262 3-WIRE GROUNDING DEVICES

FIND OUT WHY

Write Dept. ECM-762

PASS & SEYMOUR INC.

SYRACUSE 9, N. Y.

BOSTON CHICAGO LOS ANGELES SAN FRANCISCO

Code Forum

Answered by:

R. L. LLOYD, *Electrical Safety Engineer, National Bureau of Standards, Washington, D. C.*

B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

Clock Outlet

Q. *Is it the intent of Code Paragraph* 220-3(*b*) *to permit a clock outlet to be installed on the kitchen small appliance circuit in a dwelling?—N.B.*

A. Actually, many inspectors seem to feel that the clock outlet may be installed only on this small appliance circuit. Actually the intent of the code is to permit its installation on any 15- or 20-amp branch circuit in the dwelling.

The proposed 1962 Code clears this up as follows:

"Receptacles installed solely for the support of and the power supply for electric clocks **may** be installed on lighting branch circuits." —B.Z.S.

Protecting Equipment From Remote Hazards

Q. *On two occasions within the last few years a lift station, which pumps surface water from a low level over a retaining levy into a lake, has had motor and control equipment fires due to the ignition of gasoline from either motor or control equipment. The gasoline is carried with water to the pit or pump area where the motors and control equipment are located. Automatic controls start and stop pump motors according to the amount of water or liquid in the pit or tank. The service station responsible for the gasoline spillage or leakage was located several hundred yards from the pumping station, and the trouble was traced to a rupture in their underground tank. After excessive rains the gasoline would be carried to the pumping station. The oil company owning the service station where the leak occurred takes the position that explosion-proof equipment should have been installed in the remote pumping station. Does the NEC require such equipment to be explosion-proof?—J.B.*

A. The NEC does not require such equipment to be explosion-proof. The National Fire Protection Association has at least two bulletins that are pertinent to the subject raised in your statement. One is No. 328-M, titled "Control of Flammable Liquids and Gases in Manholes, Sewers and Similar Underground Structures." In the appendix to this publication, several recorded cases similar to yours are given. The other NFPA publication that I refer to is NFPA No. 329-M, "Leakage from Underground Flammable Liquid Tanks." Neither of these publications specifies the type of electrical equipment.

I would certainly suggest that design engineers, who are formulating plans and specifications for such installations, make a study of these NFPA publications. With proper design and equipment specifications, the previously indicated hazards can be eliminated.—R.E.W.

Store Lighting

Q. *When wiring a store building for service and lighting branch circuits, does the* 3 *watts per sq ft in Table* 220-2(*a*) *take care of receptacles for illumination?—S.S.*

A. Yes. It should be noted that paragraph (b) of Section 220-2 is applicable for lighting other than general illumination. For example, in a store displaying floor lamps and lighting fixtures, the receptacles used for illumination in this case is not for the purpose of furnishing general lighting within the store. In this case the 3 watts per sq ft do not cover these receptacles and an additional unit load as shown by the Table in 220-2(b) must be added to the 3 watts per sq ft unit load.—B.Z.S.

Radiant Heat Cable Installation

Q. *As an electrical contractor my attention has been called to the fact that certain surface temperatures should not be exceeded where gypsum board is used as a ceiling and radiant heat cable is installed. In many cases it has been our policy, and has been approved by local inspection authorities, to install an extra amount of cable in certain areas, such as bathroom ceilings, in order to properly heat such rooms or areas. Would appreciate your comments concerning such installations.—J.E.G.*

A. I will base my answer on some published information from sources that I consider completely reliable and also on some statements that were made to me by certain parties interested in electric heat. "The Gypsum Association in its 1959 bulletin Special Recommendation for Radiant Heating with Gypsum Wallboard, AIA File Number 23-L, emphatically states: 'Under no operating conditions shall the gypsum board core exceed a temperature of 125°F.'"

A manufacturer of listed heating cable, who is a pioneer in the field, manufactures a nylon-jacketed cable at 75 Btu square foot maximum. In the Underwriters' Laboratories report the surface temperature for this cable exceeds the limit as recommended by the Gypsum Association bulletin. The same company manufactures another cable that is a special dry-wall cable that is a 60 Btu per square foot maximum. This cable in the Underwriters' test was well below the recommendations of the Gypsum Association. This company recommends the lower rated cable for use where the so-called dry-board and plaster method of ceiling is used, which is in line with the findings of the Gypsum Association.

It is my information that the Association has determined through testing and other experience that

$30,000 a year is saved in this office by clock-controlled G-E Remote-Control Wiring system that "remembers" to turn OFF lights after hours.

At 5:30 P.M. in this office–12,000

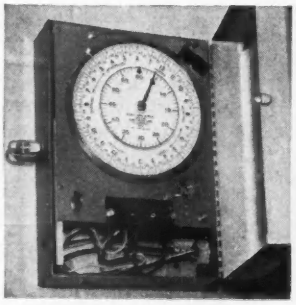
General Electric Remote-Control Wiring does the

Unneeded lamps left ON overtime used to cost a pretty penny in this large office area.

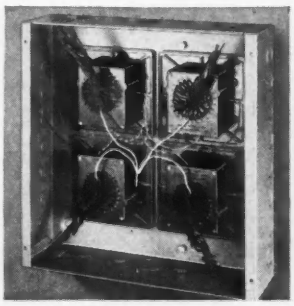
In spite of everyone's best efforts, human forgetfulness, plus the inconvenience and confusion caused by hard-to-find switch panels — wasted an estimated $30,000 a year in unnecessary power consumption, lamp replacement labor, and air-conditioning costs.

Company engineers and an electrical contractor solved the problem neatly, and at minimum cost, with clock-controlled G-E Remote-Control Wiring.

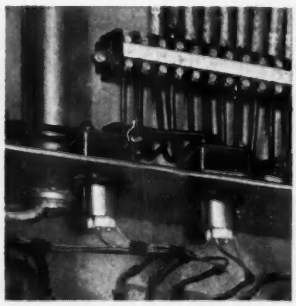
With the new General Electric system, 12,000



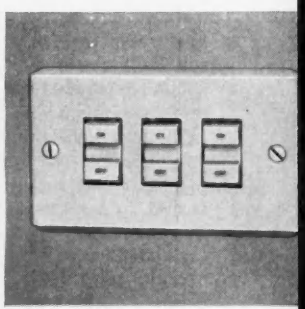
With G-E Remote-Control, one program clock controls any number of circuits through a series of G-E 25-contact Motor-Master Controls.



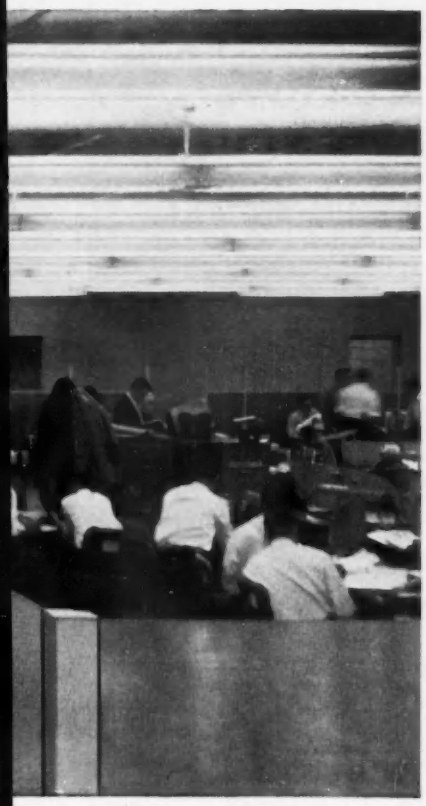
First control, started by clock, "sweeps" 25 circuits ON or OFF. One circuit starts next control, etc., on down the line. (Shown not wired.)

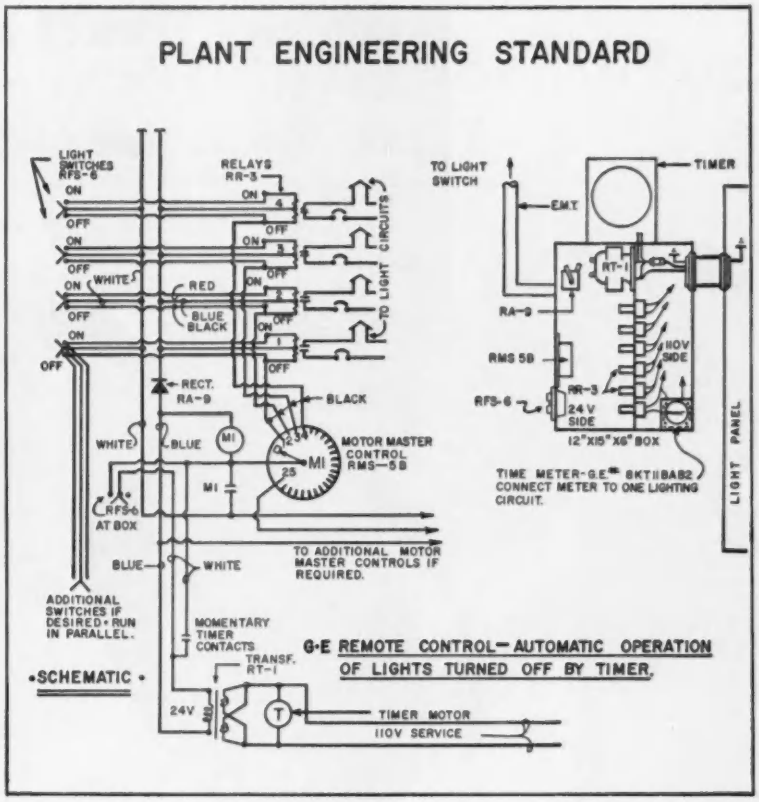


G-E relays, cut into light circuits, do the switching (20-amp. rating). They are actuated by low-voltage pulses from Motor Masters.



Wall switch control can be added to relays. G-E push-button, trigger and locking styles available — plain, pilot- or locator-lighted.





lamps go off automatically

whole job at one signal from a program clock

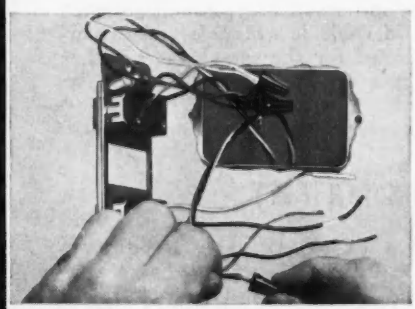
lamps are turned OFF automatically at 5:30 P.M. 1,000 selected lamps are left ON as night lights.

Late workers who need light use convenient G-E Remote-Control wall switches to turn lights over their own areas back ON.

The system repeats its automatic turnoff procedure again at 7:30 P.M., 9:30 P.M., and 12 midnight, to take care of lights turned temporarily back ON.

Company management reports that the General Electric Remote-Control Wiring system is amazingly maintenance-free, and was added with little disturbance to existing wiring.

If *you* want to provide modern program clock control of lighting at minimum cost — write for details about G-E Remote-Control Wiring. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.



Lightweight 24-volt control wiring connects Motor Masters and switches to relays —saves copper. Color coding simplifies installation.

Progress Is Our Most Important Product

GENERAL ELECTRIC

PLM Type
ACSW Terminator

Wet locations?

There's a PLM fitting to fit the job!

Terminating armored cable where a watertight cable entrance seal is needed? There's a PLM terminating fitting designed to fit the job—as there is to fit almost any other indoor or outdoor mounting requirement! The Type ACSW Terminator shown provides a compound-filled, watertight entrance seal in any position for jacketed armored cable. Variations available for non-jacketed. Other types meet needs for flange mounting on pothead bases or switchgear, or for angular, bracket or other special mounting.

PLM Terminating Fittings and Splicing Kits can speed up and simplify any cable installation or repair. Supplied for use with interlocked armored cable, non-metallic jacketed cable and lead-covered cable. PLM 52-page catalog 301 contain full description and prices. Write for copy on your letterhead.

PLM Products, Inc.
TERMINATING AND SPLICING ACCESSORIES

3875 WEST 150th STREET • CLEVELAND 11, OHIO

a chemical process called calcination takes place when gypsum board is exposed to excessively high temperatures. When so exposed for a sufficient length of time the gypsum will sag, then turn to powder and eventually will disintegrate. We have seen similar occurrences with the wrappings on steam pipes, radiators or other sources of heat.

I will state that apparently electricians in our state have done a good job of their installation of radiant heating cable as the reported cases of trouble from all causes has been a very minimum; and in practically all cases investigated, the original installation did not conform to the manufacturer's recommendations and recognized standards.—R.E.W.

Type NM Cable

Q. *Can the plastic-jacketed Type NM cable be installed in the air voids of concrete blocks located in outside walls? Section* 336-3.—*C.S.*

A. I have not run into the plastic-jacketed type NM. Usually this is Type NMC.

There is no question relative to the use of Type NMC, it may be installed as asked in the question.

With reference to Type NM, it may be installed in these walls if ". . . they are not exposed or subject to excessive moisture or dampness." Ordinarily these walls are subject to excessive moisture and dampness since they are outside walls relatively dry. Under these outside walls with insulated brick veneer finishes, etc., that in effect keep these outside concrete block walls relatively dry. Under these conditions the local inspector may permit the use of Type NM cable. —B.Z.S.

Editor's Note: Plastic-jacketed NM cable is available and is permitted for the same uses as other types of type NM cables.—J.H.W.

Buried EMT

Q. *Can thin-wall conduit (EMT) be buried in a non-cinder concrete slab which is in direct contact with the earth? If yes, what type connectors are required for such an installation? Can concrete tight EMT connectors be used*

Electromode unit heater blower

suspends commercial and industrial heating problems!

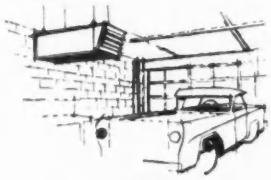
SAFE . . . first and foremost advantage with every ELECTROMODE product! The Exclusive Safety-Grid . . . only Electromode has it. The electric heating element is embedded and completely sealed inside the finned aluminum casting. There are no open wires or glowing elements.

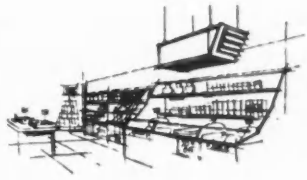
VERSATILE . . . use one or a number for complete or supplementary heating, in small buildings or large industrial plants.

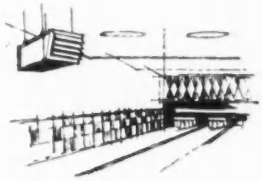
CLEAN . . . flameless heat is smokeless and fumeless heat. Healthier working conditions; and equipment stays clean longer.

PRACTICAL . . . ceiling suspension frees valuable floor space, also cuts initial construction costs.

QUIET . . . heavy duty, mat-faced fiberglass insulation reduces operating sounds.







KEEP PACE ELECTRICALLY

Electromode

Division Commercial Controls Corporation

ECM-72 ROCHESTER 3, NEW YORK

COMPLETE LINE: Features more than 400 types, models and capacities of heaters and heating systems, all with **exclusive** Safety Grid. The solution to your heating problem is in the Electromode catalog.

Powerful new...

YOU'LL LIKE THE NEW SIOUX NO. 1450 AIR DRILL!

It's so light and powerful! It feels so right in your hand! Squeeze the trigger . . . it runs slowly at first so that you can get the drill bit started. Now *squeeze* the trigger for the full power and speed of the big 1/3 H.P. air motor! It's almost impossible to stall it. The motor can't be burned out. A remote exhaust system carries air and lubricant away from the work and the operator. The five vane air motor is automatically lubricated, as it runs, from a reservoir in the handle.

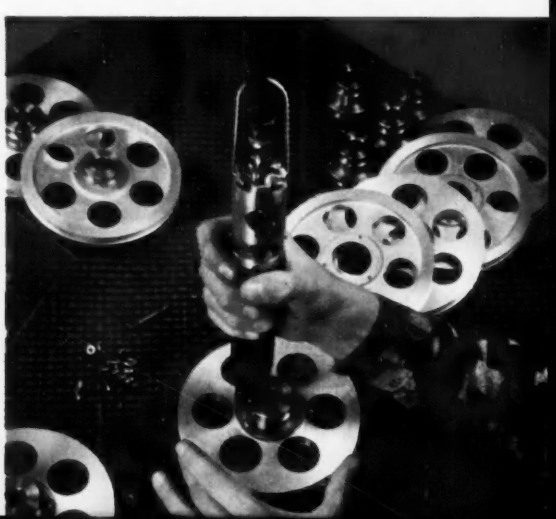
Change the speed to suit the work with an easy screwdriver adjustment! Compare any ¼" air drill with this one for power, quality, design features, and performance. We think you'll agree, this SIOUX air drill has got it!

It's shipped with deflecting silencer, eight feet of leader hose, and fittings including one swivel fitting all as standard equipment.

Ask your **SIOUX** *Distributor for Catalog 62*

SIOUX

The SIOUX L2205 Air Screwdriver is ideal for many high speed assembly jobs such as this.



..SIOUX

¼" air drill!

High speed run down to proper tension—it's yours with the new SIOUX No. 473 Impact Wrench!

Notice how the full strength and control of the operator's arm and hand are applied directly above the drill bit of the SIOUX No. 1495 Electric Drill.

ASSEMBLY TOOLS BY SIOUX

Handles, air motors, gear cases, chucks and clutches of SIOUX P, A, and L prefixed air drills, screwdrivers and nutrunners are interchangeable. You may have a pistol grip, or lever handle, with choice of speed from 600 to 4,000 RPM, equipped with a 1/4", 5/16" or 3/8" chuck. Disassembly for service or conversion to another job is easy. Air and lubricant are exhausted away from the work and the operator. You'll like SIOUX simplicity in design and the fine precision manufacture in these and the other assembly tools shown here in action.

Super Powered SIOUX No. 262 Electric Screwdrivers have the speed and power which modern assembly operations demand.

PORTABLE AIR & ELECTRIC TOOLS
AND ABRASIVES

ALBERTSON & CO., INC.

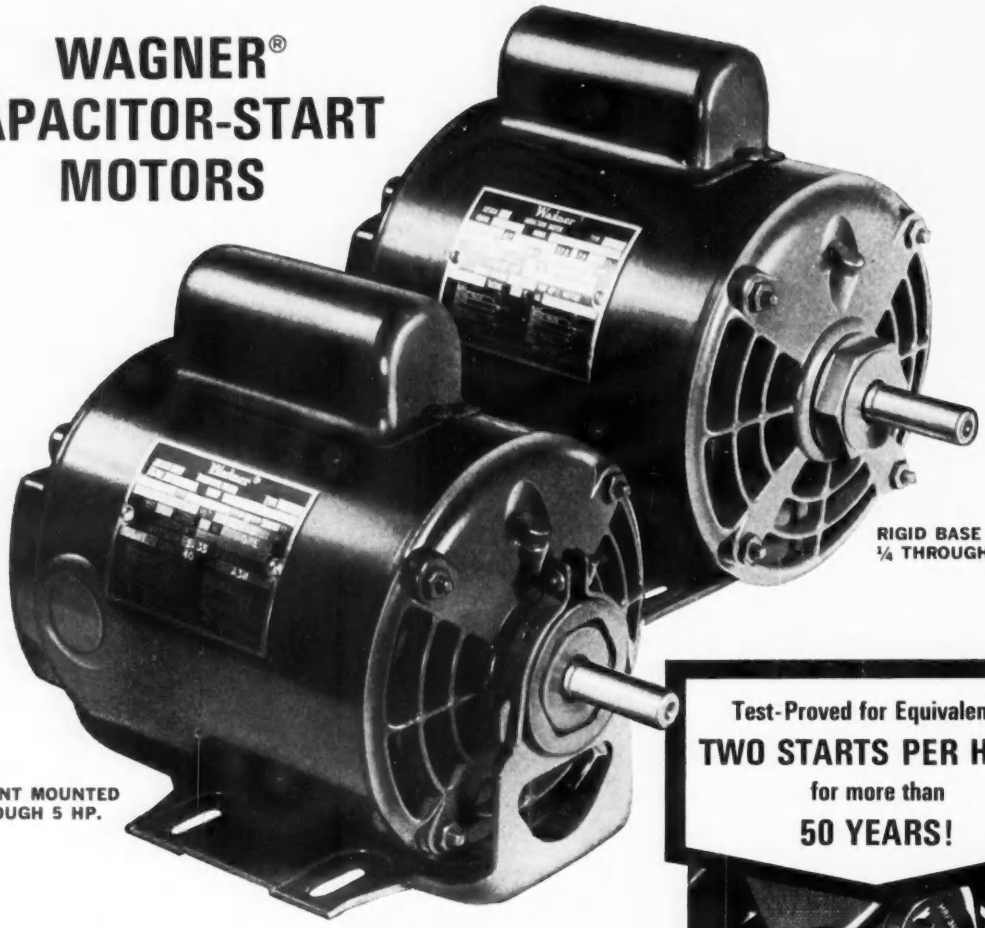
SIOUX CITY, IOWA, U.S.A.

The new SIOUX No. L1940 Air Grinder and Deburring Tool is intended for applications such as deburring castings.

There's a minimum of operator fatigue with a drill that only weighs 2 lbs., 4 oz. Yet it delivers a full ⅓ H.P.! It's the new SIOUX No. 1450 ¼" Air Drill!

The SIOUX A2106 Air Nut Runner with 90° Angle Drive solves close quarter assembly problems.

WAGNER® CAPACITOR-START MOTORS



RESILIENT MOUNTED
¼ THROUGH 5 HP.

RIGID BASE
¼ THROUGH 5 HP.

. . . designed for LONG, TROUBLEFREE SERVICE

Here are general purpose single-phase motors with proved, built-in ruggedness . . . packed with power, but small enough to fit into tight spots.

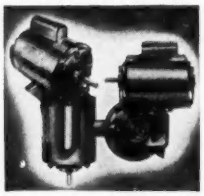
Wagner® Type RK Capacitor-Start Induction-Run motors have high starting torque and high pull-in torque. Properly applied, they'll give positive starts every time . . . year in and year out.

These motors . . . all with dynamically balanced rotors . . . are available in a range from ¼ through 5 horsepower, with sleeve or ball bearings, and with rigid or resilient bases.

Get these motors from leading motor distributors in your area, or from Wagner sales offices in 32 cities across the country. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details.

Test-Proved for Equivalent of
TWO STARTS PER HOUR
for more than
50 YEARS!

Quick Break Switch—Starting winding is disconnected from the line by this Wagner-designed quick break switch . . . test-proved to make more than a million breaks (equal to two starts per hour for more than 50 years).

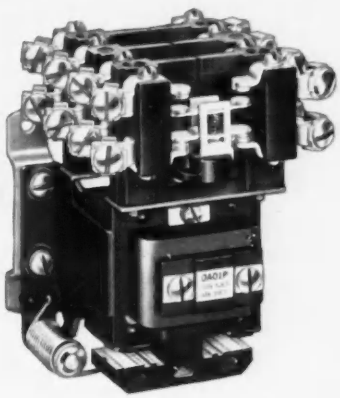


All-Angle Operation—Sleeve bearing fhp models have a positive lubrication system that permits operation in any position . . . can mean important savings in costs to manufacturers.

Wagner Type RY capacitor-start capacitor-run motors, 15 horsepower and smaller, are also available.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED® Products

WM62-10

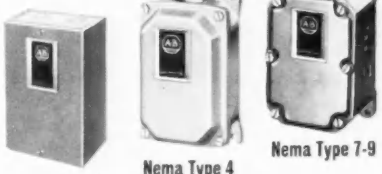


Bulletin 700, Type BX
A.C. Control Relay
10 Amps, 600 Volts Max.

Yes Sir! ALLEN-BRADLEY Combines Small Relay Size With Many Millions of TROUBLE FREE OPERATIONS

Possibly Allen-Bradley relays are not as small as some, but no other relays on the market can equal their performance. Rugged, simple mechanical design came first. Then we made them last longer than you've ever imagined possible. Next, we designed a unique contact motion for greater electrical reliability. We also developed a new pressure molded coil—for complete protection against *any* atmospheric conditions and mechanical damage.

Try the Allen-Bradley relays on some of your really tough jobs—the reliability will surprise you! You should get *all* of the facts for yourself by writing for Descriptive Bulletin 700: Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Nema Type 1 | Nema Type 4 | Nema Type 7-9

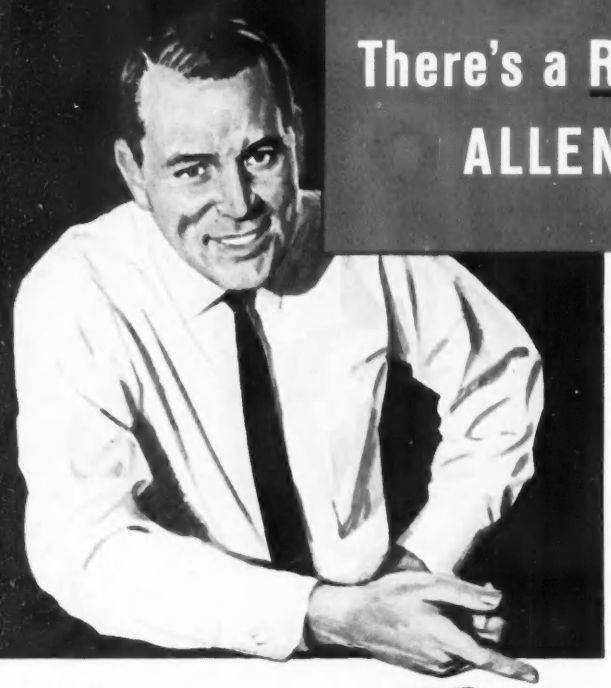
A-B has the enclosures for any type of service requirement. Nema Type 1 is for general purpose installations. Nema Type 4 is the watertight and weatherproof enclosure. Nema Type 7-9 provides protection in hazardous locations.

18-04-2

ALLEN-BRADLEY

Member of NEMA

QUALITY
MOTOR CONTROL

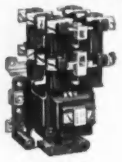


There's a Reason For Each of These ALLEN-BRADLEY RELAYS

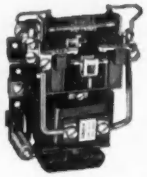
No one relay will satisfy *all* operating requirements! Allen-Bradley has provided the necessary variety to satisfy any and all of your operating conditions. But all of these relays have a family similarity. They are all simple in design—your guarantee of millions of trouble free operations. They are all equipped with pressure molded coils—the worst possible atmospheric conditions cannot harm these coils. All contacts are silver—they do not require service attention!

Better get the complete story—write for Descriptive Bulletin 700: Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

General Purpose Furnished with from two to eight poles with a maximum of 8 N.O. contacts or 4 N.O. and 4 N.C. contacts. Can also be supplied with overlapping contacts. For two or three wire pilot control.



TYPE B



TYPE BA

Three Wire Pilot Control Designed for use with three wire gauge type thermostat or similar pilot control having a slow moving element, which makes contacts for both "open" and "closed" positions. Built with hold-in contacts.

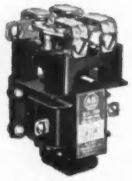
TYPE BX

Universal Has both N.O. and N.C. contacts. Switching poles can be changed from N.O. to N.C. by changing the terminal wiring connections. The 2 and 4 pole types have both N.O. and N.C. contacts. In the 6 and 8 pole construction, these additional poles have N.O. contacts only.

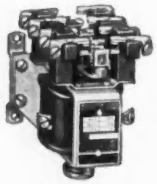
Convertible Contact Contacts are easily converted from N.O. to N.C. (and vice versa) in a matter of seconds. Permits rapid circuit changes. Made with from 2 to 8 poles. N.O. overlap contacts are also available.

TYPE BR

Heavy Duty Extra heavy contact structure permits higher pilot currents to be handled. Contacts rated 25 amperes, 300 volts max. These relays are supplied in single and two pole construction only.

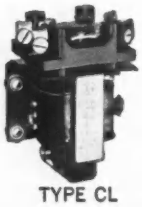


TYPE D



TYPE E

General Purpose D.C. For direct current applications. Made with from 2 to 8 poles in various combinations of N.O. and N.C. contacts. Also furnished as universal type with both N.O. and N.C. contacts.



TYPE CL

Low Coil Current The smaller construction makes these relays ideal where space is limited. Used where low operating coil currents are important. Suitable for use in temperature controls. Two or four pole construction with either N.O. or N.C. contacts.

Compact D.C. Smaller than Type E, these relays are ideal where space is a problem. Made in 2 pole construction only with either 2 N.O. contacts or 2 N.C. contacts. Also made with 1 N.O. and 1 N.C. contacts.

TYPE G

19-04-2

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

where exposed to weather? Can raintight connectors be used in concrete slab work?—E.V.

A. You will note that Section 348-1 requires EMT to be:

1. protected on all sides by a 2-in. layer of non-cinder concrete, or

2. 18 in. below the cinder concrete or fill.

Section 348-8 is not too definite as to what type of connectors are required. A proposed revision in the 1962 Code is somewhat more definite in its requirements:

"Where buried in masonry or concrete, *they* (referring to coupling and connectors) *shall be concretetight, or where installed in wet locations,* shall be of the raintight type."

It is of interest to note that the Underwriters' Laboratories, Inc. in its Electrical Construction Material list shows that these fittings may be "concretetight" but not necessarily "raintight." However, when they are "raintight" they are usually also "concretetight."—B.Z.S.

Receptacles in Anesthetizing Locations

Q. *Can general-purpose duplex receptacles or general-purpose lock-in type receptacles be installed in anesthetizing locations at more than 5 ft above the floor? This question is prompted by the* 1959 *edition of NFPA Code* 56 *which implies that all receptacles in these locations must conform to Fig. A* 2438, *page* 56-45.—*L.C.D.*

A. The National Electrical Code does not specify the types of receptacles that may be used in the area as recorded in your question, and as you state NFPA 56 implies that receptacles be according to Fig. A 2438; such drawing being a part of NFPA No. 56. However, under A 244, Arrangement of Circuits (in the fine print note) it is implied that call systems, public address systems, special clock circuits, etc., are normally supplied from ungrounded systems, and it states that the usual location is well above the 5-ft limitation for the hazardous location. Therefore, it is implied that the purpose for which the receptacle is to be used could govern the type installed.

In my opinion the most important question arising in the installation of the receptacles above the 5-ft

Drill fast, clean holes in all masonry

with the new

STANLEY Portable Electric IMPACT DRILL

Unique disintegrating action (best for drilling clean, accurate holes in masonry) is produced by simultaneous high frequency impacting and high speed rotary drilling actions.

Compact, portable one-man tool designed for easy, safe operation and less operator fatigue.

Low per-hole costs because need for expensive drilling stands and extra man-power is eliminated. Dry cutting method needs no set-up time. Unique disintegrating action minimizes bit wear.

Minimum fracturing and spalling virtually eliminates costly post-installation repairs and resurfacing of adjacent areas.

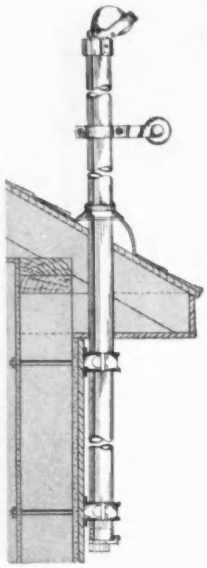
Greater capacity and utility makes the Stanley Impact Drill useful for a wide variety of masonry drilling jobs. Models No. 402 and 405 encompass a cutting range from 3/16" to 5".

See Your Stanley Supplier or write direct . . .

STANLEY POWER TOOLS

STANLEY®

DIVISION OF THE STANLEY WORKS
877 MYRTLE STREET
NEW BRITAIN, CONNECTICUT



Buy the part or buy the package...

M&W

MAST KITS

save on installation costs

Modern, time-saving slip-fittings used throughout — eliminating thread-cutting and reducing installation time. Choose from the most complete line of Mast Fittings available. Sizes for 1¼" to 4" conduit risers. Save, too, on M&W's complete line of Service Cable Fittings.

Send now for Catalog EF-61.

M&W Electrical Fittings

The M. & W. ELECTRIC MFG. CO., Inc.

EAST PALESTINE, OHIO

12 foot rolling tower for LESS THAN $135*

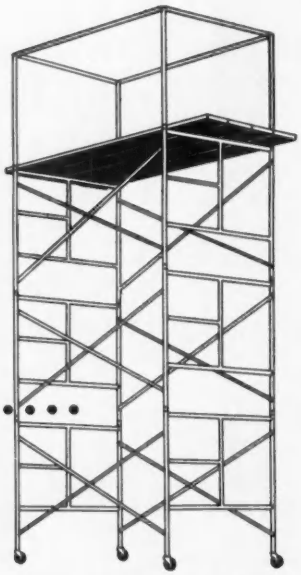
HERE'S WHAT YOU GET

- 6 - 4' x 4' frames
- 6 - cross braces
- 4 - guard rails
- 4 - guard posts
- 4 - locking swivel casters

Now, for little more than the price of a good ladder, you can increase efficiency and safety on all overhead installation and maintenance jobs with a convenient Safway rolling tower. Rigid, lightweight 4' x 4' steel frames support loads to 50 lbs. sq. ft. Are easy to handle, transport and assemble without tools. Finished in weatherproof enamel.

Special package builds 4', 8' or 12' high tower, with roomy 4' x 7' base area. Can also be used for 4' high by 21' long stationary scaffold. Get one for each crew at this low price.

*Approx. price, less planks. See your dealer for exact delivered price.



See your Safway Dealer, or write for Bulletin 87F.

SAFWAY

SAFWAY STEEL PRODUCTS, INC.

6228 W. State St., Milwaukee 13, Wisconsin

SWP-46

limit is the use that they are to perform. If the receptacles are to serve portable equipment used below the 5-ft area, and since approved equipment for this area would be equipped with receptacle caps conforming to the configurations mentioned in NFPA 56 (A 2438), such receptacles, whether explosion-proof or general purpose, should have the same slot configurations to receive the standardized receptacle caps of the equipment.

Section 2438 of NFPA 56 (d) reads:

"All plugs and receptacles for use in anesthetizing locations shall be designed for interchangeability, for direct connection without the use of adapters with Class I, Group C receptacles in hazardous locations and lock-in type general-purpose receptacles in nonhazardous locations.

Exception: Receptacles provided for services having different voltages, frequencies or types on the same premises shall be of such design that attachment plugs and caps used in such receptacles cannot be connected to circuits of a different voltage, frequency or type, but will be interchangeable within each such classification."—R.E.W.

Editor's Note: Revised Paragraph 517-4(a) of the 1962 NEC requires receptacles and caps per Section 2438 of NFPA No. 56—J.H.W.

Conductors in Multiple

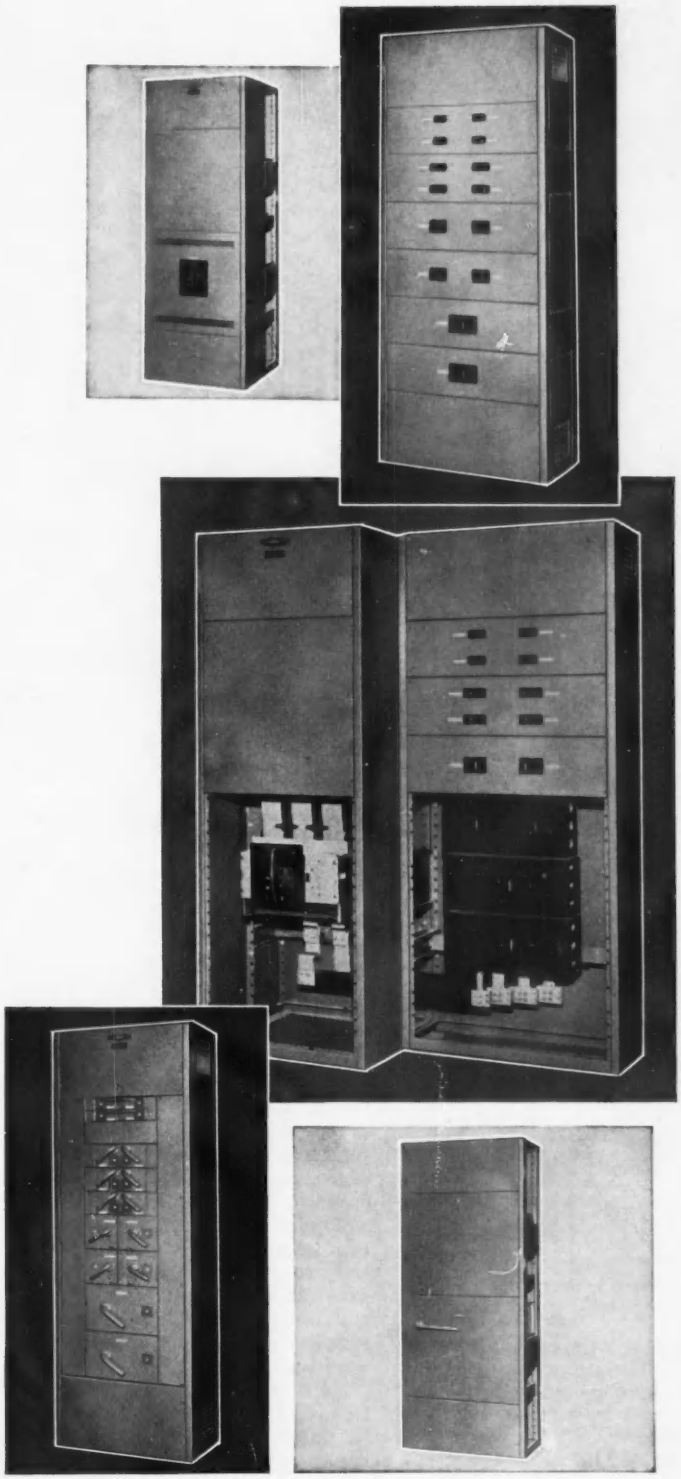
Q. *Does the* 1/0 *size limitation for conductors in multiple apply also to the neutral conductor? See Section* 310-10.—*J.C.H.*

A. Yes. There is nothing in this requirement that exempts the neutral conductor.—B.Z.S.

Derating Buried Conductors

Q. *Where a number of approved single-conductor cables are buried in the same trench or ditch, should these conductors be derated in accordance with Note* 8 *preceding Table* 310-12 *and the fineprint at the top of Table* 310-12?—*A.E.D.*

A. Yes. Note 8 refers to Tables 310-12 and 310-14. The note at the top of these tables specifically refers to ". . . direct burial."—B.Z.S.



I-T-E UNI Power

modular constructed, front connected, pre-engineered

SWITCHBOARDS COMPLETELY BUSSED

I-T-E Uni-Power design permits use of one section, or a combination of cross-bussed sections. Complete factory bussing makes installation quick, easy, and eliminates the assembly of many components. Pre-engineered components meet the requirements of customized jobs.

FUSIBLE OR BREAKER

main service disconnects and distribution sections

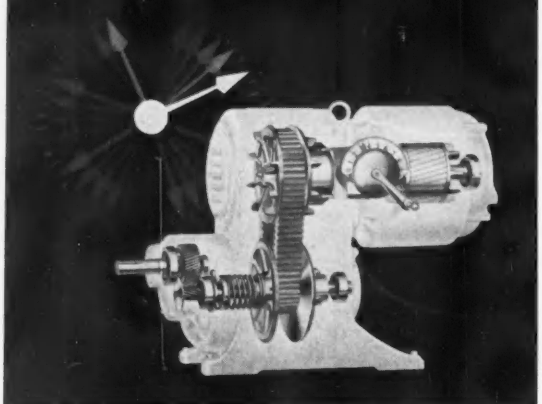
Uni-Power Switchboard components are manufactured by highly specialized divisions within the I-T-E corporation and then assembled at I-T-E Area Service Centers strategically located to allow superior delivery. Convenience plus I-T-E quality is yours. Buy the switchboards built for engineers and contractors who are proud of their work. Always specify I-T-E quality.

LEARN MORE

Contact your nearest I-T-E sales office. Request a copy of Bulletin 9200-1A.

I-T-E CIRCUIT BREAKER COMPANY

any RPM simply on AC!
U.S. VARIDRIVE MOTORS



Just plug into standard AC lines and dial the speed you want! With U.S. VARIDRIVES, you don't buy a DC converter, DC generator, delicate and complicated electronics circuits. VARIDRIVE in one compact, self-contained unit gives you dependability, simplicity, ease of maintenance. Smooth, stepless speed changes are made at will. Available in ¼ to 100 h.p. Specify: "U.S. VARIDRIVE MOTOR."

For Complete Information, Request Brochure F-1797

U.S. ELECTRICAL MOTORS Inc.
Box 2058, Los Angeles 54, California—or Milford, Conn.

You can SEE IT'S

BLACKHAWK

One look tells you that these holding and fastening fittings will install quicker, easier

These are only a few of Blackhawk's complete line of quality holding devices designed to give you fast, easy, accurate installation in *any* wiring situation.

Each fitting is carefully engineered to assure you of top quality and years of trouble-free use. Compare Blackhawk with other fittings — you can actually see the difference.

At Blackhawk, the smallest fitting is designed to specifications as exacting as those of larger, more complex electrical equipment.

With Blackhawk you can see the difference — in the part and in the job it does. Your reputation for quality workmanship depends on the quality of the products you sell — and when it comes to quality you can see it's Blackhawk. Next time you need holding and fastening fittings, buy Blackhawk and see for yourself.

Blackhawk Industries

Blackhawk Industries, Dubuque, Iowa

Where the new ideas come from

Four-Wire Delta

Q. *Is any standard method—color or otherwise — now being considered for identifying the "high leg" as required by Section 200-6?—F.N.*

A. Yes, this was again considered by the Code Panel for revision of the 1959 Code. There was a definite proposal that the 1962 Code set aside the color "red" for this purpose. However, "red," like "green," "white," "black" or "blue" are colors which are now assigned by the code—see Section 210-5.

To emphasize the need for a distinctive indicating means the 1962 Code will propose the use of the word "tagging" instead of "painting" in Paragraph 200-6(c). "Painting," however, still will be recognized under the permission of "other effective means," which phrase will be retained in the proposed 1962 Code. The use of "tagging" will give the local inspector a means of obtaining somewhat more definite identification of this third voltage source in the system. —B.Z.S.

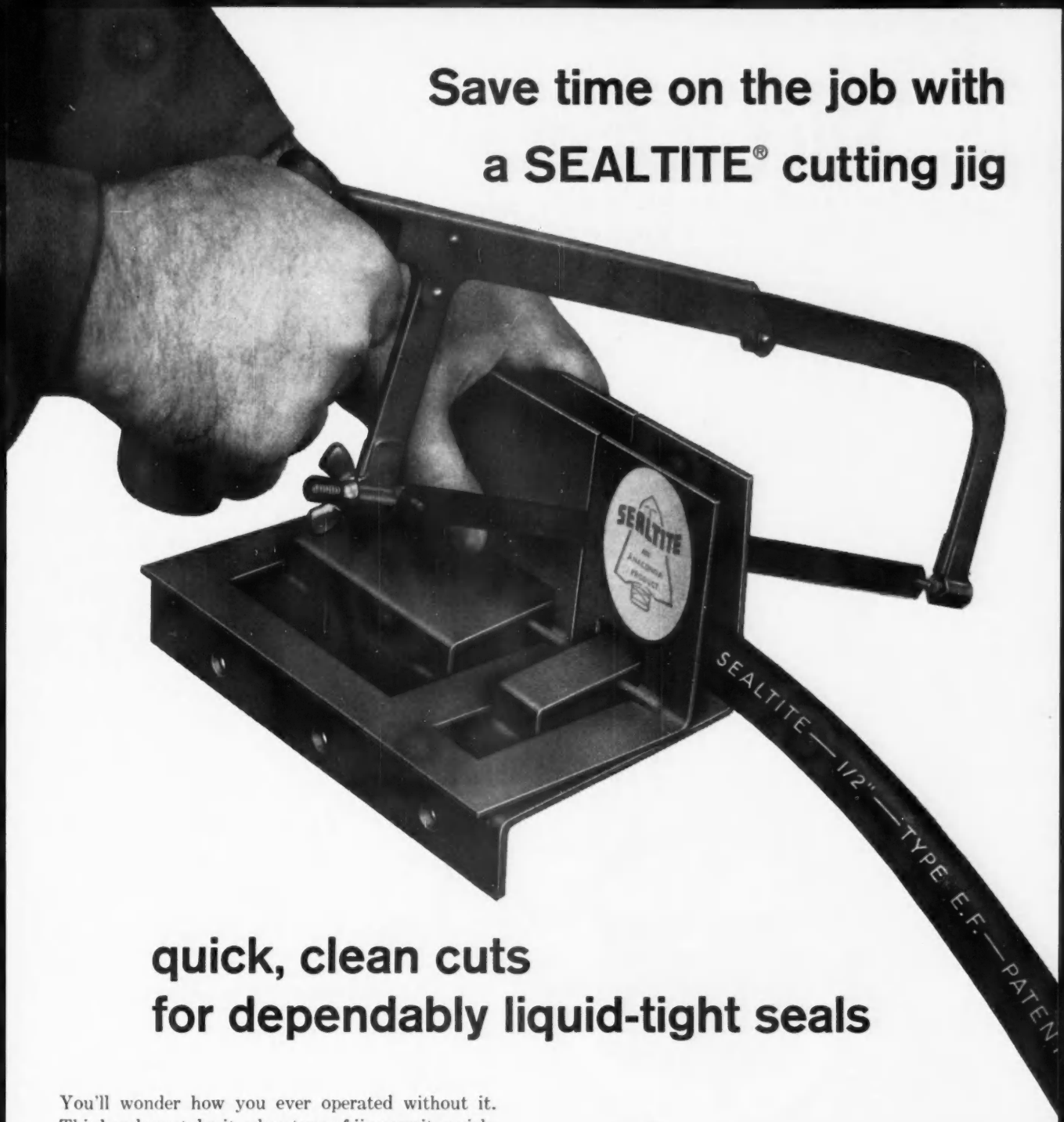
Receptacle Outlets

Q. *Is it a requirement of the code that a receptacle outlet or outlets be installed in the bathroom?—J.E.F.*

A. Article 210, Section 210-22, specifies where receptacle outlets are required, and no mention is made of the bathroom location. This section does specify that grounding-type outlets be installed in certain locations, including the locations where the outlet may supply equipment used by persons standing on the ground or on grounded conductive materials, and in a large percentage of bathrooms the requirement would be for grounding-type outlets. This is another question where there is a wide difference of opinion and different requirements existing.

FHA requires a convenience outlet installed in a bathroom and shall be adjacent to the mirror or included in the light fixture adjacent to the mirror. The "Residential Wiring Handbook" that is published by the Industry Committee on Interior Wiring Design (a committee sponsored by many of the leading organizations in the United States interested in better wiring

Save time on the job with a SEALTITE® cutting jig



quick, clean cuts for dependably liquid-tight seals

You'll wonder how you ever operated without it. This handy metal mitre-box type of jig permits quick, on-the-job cutting of SEALTITE, the flexible liquid-tight conduit. You'll get a clean, square cut every time assuring a full-contact fit when inserted in a liquid-tight connector.

The SEALTITE cutting jig is portable, easy to use, and can be put in a vise or attached to work bench. Available at your Sealtite Electrical Wholesale distributor at nominal cost. Buy your SEALTITE in economical reels and cut the conduit quickly to required lengths. Always specify SEALTITE by Anaconda, the original, the best—yet costs no more.

FOR MORE INFORMATION on SEALTITE Cutting Jig or on SEALTITE, write: Anaconda Metal Hose Division, Anaconda American Brass Company, P.O. Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., Montreal 2, Quebec. 61-1903

ANACONDA®
METAL HOSE DIVISION

FREE

DIAMOND DI-EX TEST SET

Prove the time and cost savings of this new one-piece masonry anchor . . .

Just give us a call or drop us a note and we will send you your DI-EX TEST SET . . . also a "Comparative Cost Study — DI-EX vs. Self-Drilling Shields." This will show you:

TIME SAVINGS 64% COST SAVINGS 37%

DIAMOND EXPANSION BOLT COMPANY, INC.

506 North Avenue, Garwood, New Jersey

CIRCUIT BREAKER TESTER

MULTI-AMP high-current, low-voltage portable circuit breaker test units provide a safe, economical method for testing molded-case and low-voltage, single-pole or multi-pole power circuit breakers in the field, shop and laboratory. Multi-Amp engineers will gladly work with you in the design of special equipment for your specific needs. Bulletin SB-CB-1 on request.

MULTI-AMP® Electronic Corporation
61 Myrtle Street, Cranford, N. J. BRidge 6-8200

Portable, mobile, stationary and laboratory equipment to take the guesswork out of electrical protection and provide continuous power for continuous production.

for residential occupancies) recommends the placing of convenience outlets in bathrooms with outlets at each separate mirror or vanity space, and also at locations where electrical equipment may be used, such as an electric razor.

In the Canadian Electrical Code, it is stated that receptacles shall not be installed in bathrooms unless supplied from an approved combination isolating transformer and electric shaver receptacle, which shall be located as far as practicable from the bathtub. There is also a special permission rule for hotels and motels that states the isolating transformers specified in the above sub-rule may be installed separately from the receptacles provided that each supplies a single receptacle marked to indicate that it is for use with a shaver only.

From the above one can readily see that there is certainly a difference in requirements and recommendations concerning the use of receptacle outlets in bathrooms. As a result, the local inspection authority should be consulted even though the NEC does not specifically require a convenience outlet in a bathroom.—R.E.W.

Long Periods of Use

Q. *A single appliance is installed on a branch circuit and the use of the appliance is such that it will be in use for long periods of time.*

Is it the intent of Section 210-20 *to limit the overcurrent device to* 150% *of the appliance rating? Example,* 18*-amp load on* 2*-pole* 30*-amp breaker. A* 25*-amp breaker is not available.—M.W.H.*

A. Let's analyze this a bit. According to Paragraph 210-23(b), because of the "long period of use," the total load cannot exceed 80% of the branch-circuit rating. On the basis of the 18-amp load the branch-circuit rating will have to be at least 18/0.8 or 22.5 amps. There is no standard 22.5-amp breaker, so we would have to go to the next standard size, or 30 amps. This is beyond the 150% rating of the appliance as set up by Paragraph 210-20(b), viz., 1.5 × 18 is 27 amps. In my opinon, this would be safe, but I am sure there are many inspectors who would not agree, and even some who would require a 25-amp fuse for protection.—B.Z.S.

Household Ranges Over 12 KW

Q. *Several companies are now advertising household electric ranges rated above 12 kw. As an example, one company has advertised such a range with a total rating of 16.3 kw.*

What size conductors should be used, with overcurrent protection and rating of range receptacle, for such an installation where supply is single phase, 230 volts?—W.B.L.

A. Table 220-5, "Demand Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units and Other Household Cooking Appliances Over 1¾ kw Rating," with five notes answer your question. Note 1 pertains to ranges over 12 kw but not more than 21 kw, which covers the range in your question. This note states "the maximum demand in Column A shall be increased 5% for each additional kw of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kw." In Column A with the range not over 12 kw rating where one appliance is used, the maximum demand is given as 8 kw. The 16.3 kw is 4 kw with a minor fraction above the 12 kw. Therefore, we have 4 kw to be multiplied by the 5% for each additional kw of rating, which equals 20%. The 20% of 8 kw equals 1.6 kw, or the total maximum demand of a single household electric range of 16.3 will be figured as 9.6 kw. This equals approximately 42 amps. Therefore, this size range for household use would require a 50-amp branch circuit with receptacle, conductors, and overcurrent protection rated at 50 amps. — R.E.W.

Neutral Feeder Load

Q. *Section 220-4(d). Would it be permissible to determine the neutral capacity required for a service by using the capacity of the ungrounded conductors, minus the load not connected to the neutral? —E.W.*

A. In effect, this is required by Paragraph 220-4(d). The other factors discussed in this section must also be taken into consideration as well as the minimum size required for services and grounding.—B.Z.S.

IDEAL

VAP-OIL-TITE CONNECTORS

• for use with liquid-tight flexible, metallic conduit

• absolute water and oil-tight seal — vapor, dust, grit can't penetrate

STANDARD SIZES — ⅜" to 2"
Available in 3 styles — straight, 90° angle and 45° angle. U.L. and J.I.C. approved. Fit both EF and UA conduit. Seven sizes for each style from ⅜" to 2" conveniently packaged in lots of 5 to 100, or by carton...priced right!

LARGE SIZES—2½", 3", 4"
Straight style only. Double O-ring neoprene seals prevent foreign matter penetration—**nothing can get through!** Extra long skirt prevents damage to conduit. Three sizes, 2½", 3" and 4" packaged individually — at the right price!

EASIEST TO APPLY--NEVER PULL APART

The *only* completely reusable connectors for OEM, replacement and maintenance, and machinery applications where a positive seal against water and oil is a must!

WANT DETAILS? ...send coupon NOW

IDEAL INDUSTRIES, Inc.
1041-G Park Ave., Sycamore, Ill.

IDEAL

Send Vap-Oil-Tite Catalog data

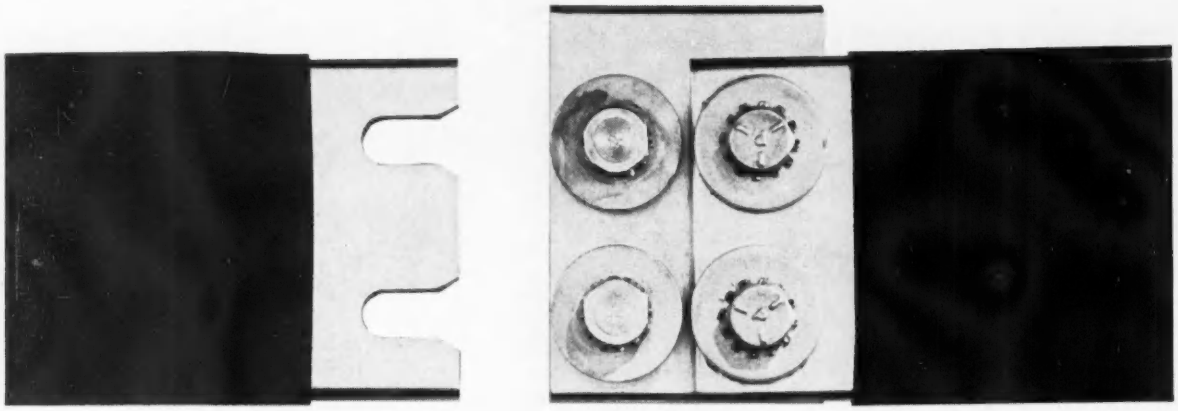
Name_____

Company_____

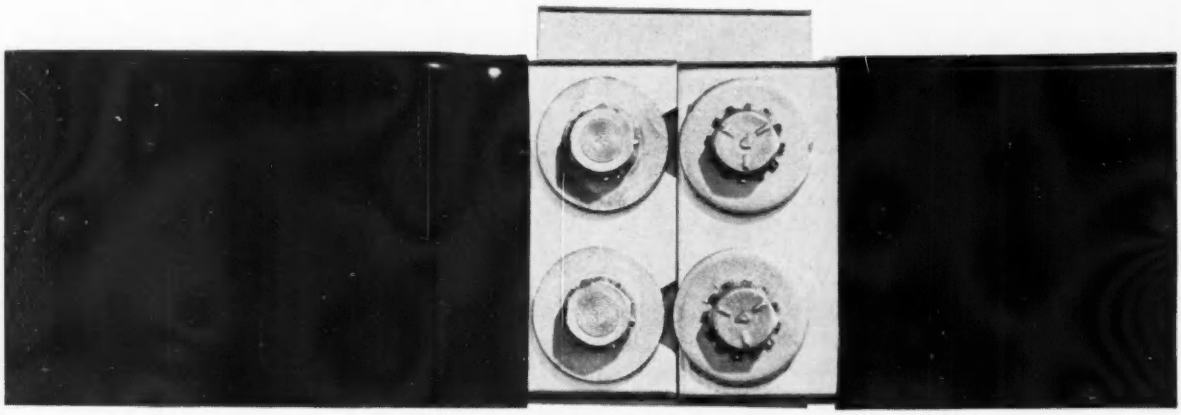
Address_____

City_____ Zone____ State_____

just slip in place



and tighten bolts



Westinghouse Plug-In Low Impedance Bus Duct cuts installation costs

Exclusive Westinghouse factory-installed captive hardware eliminates the time-consuming alignment of joints; threading and fastening of loose hardware. Just slip together and tighten from either side for a high strength, low power loss connection. Its lighter weight and small size (up to 33% smaller than other makes) contribute to easier handling especially on limited-space jobs. In one actual installation, studied by S. M. Dix and Associates of Grand Rapids, Michigan, two men installed a complete section of Westinghouse duct in less than eight minutes! Installed cost is the important cost, and no other plug-in low impedance bus duct can be installed faster than Westinghouse.

In ratings of 600 to 4000 amperes, this duct is available with copper or aluminum conductors and a complete line of fittings, hangers, and plug-in units. For further information contact your Westinghouse representative; or write, Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's Westinghouse.* J-30340

Westinghouse

NEW SUBSCRIPTION APPLICATION CARD

YES SIR ! I want to know the latest electrical estimating, wiring and maintenance methods! Enter my subscription to ELECTRICAL CONSTRUCTION & MAINTENANCE for a full year's service (13 helpful issues) for only $3.*

☐ Check here for two years at $4 (You save $2)*

*(United States and U. S. Possessions only — Canadian and overseas rates on request.)

PLEASE PRINT

NAME ..... TITLE OR POSITION.....

ADDRESS ☐ Home ☐ Business .....

CITY .....ZONE.....STATE.....

CO. NAME .....

OUR MAIN BUSINESS IS.....

I am in charge of Electric Work ☐ YES ☐ NO

Please do not write in this box.
EC-
M-

Send No Money Now—Simply Mail Card Today! EC-7-62

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed In The United States

POSTAGE WILL BE PAID BY

McGRAW-HILL PUBLISHING CO., INC.

Electrical Construction & Maintenance

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT No. 64
NEW YORK, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed In The United States

POSTAGE WILL BE PAID BY

McGRAW-HILL PUBLISHING CO., INC.

Electrical Construction & Maintenance

330 WEST 42nd STREET

NEW YORK 36, N. Y.

NEW SUBSCRIPTION APPLICATION CARD

YES SIR ! I want to know the latest electrical estimating, wiring and maintenance methods! Enter my subscription to ELECTRICAL CONSTRUCTION & MAINTENANCE for a full year's service (13 helpful issues) for only $3.*

☐ Check here for two years at $4 (You save $2)*

*(United States and U. S. Possessions only — Canadian and overseas rates on request.)

PLEASE PRINT

NAME ..... TITLE OR POSITION.....

ADDRESS ☐ Home ☐ Business .....

CITY .....ZONE.....STATE.....

CO. NAME .....

OUR MAIN BUSINESS IS.....

I am in charge of Electric Work ☐ YES ☐ NO

Please do not write in this box.
EC-
M-

Send No Money Now—Simply Mail Card Today!

EC-7-62

Chicago EASA Convention Theme Is Management

Delegates welcome emphasis on front-office problems under current economic climate; vow to apply convention Manage-for-Profit ideas to own operations.

In a radical departure from past conferences, the 29th Annual Convention of the Electrical Apparatus Service Association (formerly NISA) devoted two-thirds of its formal agenda and conference time to non-technical but highly important management subjects. The annual conference and trade show, held June 10-13 at Chicago's Conrad Hilton Hotel, drew more than 900 registrants. In line with the conference theme "I Will Manage for Profit," session speakers covered such subjects as incentive, labor, management, economics, marketing, sales, organization and advertising.

Keynote speaker James F. Lincoln, chairman of the board, The Lincoln Electric Co., Cleveland, Ohio, warned that labor-management cooperation is needed in the U. S. if we are to compete successfully with the European Common Market where operating efficiency —and competition—is increasing at a rapid pace. Incentive management is one answer to this, he noted, while revealing the results of some 28 years experience with his company's incentive program. During that time, man-hours per unit of production were reduced some 90% and even though the price of the product was reduced the profit per dollar remained constant, he added. Annual bonuses for Lincoln employees range from 30% to 138% of their yearly salaries. To achieve this there must be a "team effort" and continuous employment, Mr. Lincoln stated. His business philosophy is that the people who make profits possible should share in them, in the following order: first, the customers (lower product cost); then the employees (incentive bonuses); last, the owners (profit return).

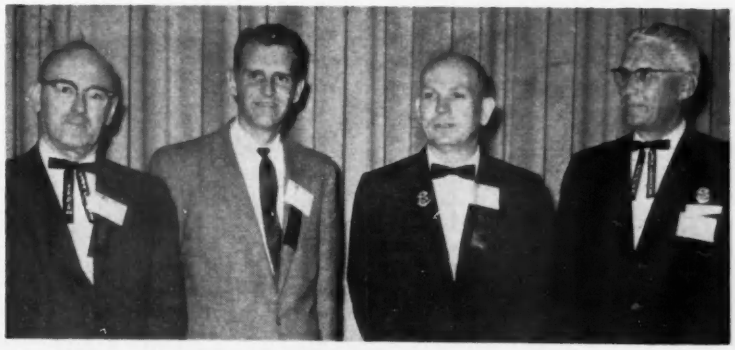
The current economic picture and its effect on business was reviewed by Dr. William A. Hayes, chairman, Department of Economics, DePaul University, Chicago. He explored government monetary and fiscal policies, the national debt, causes and cures of recessions, inflation, unemployment, etc.; noted that inflation and unemployment are the major economic problems affecting all of us. Most important current development in the labor relations field is government pressure on non-inflationary wage settlements. Dr. Hayes sees more influence of government in collective bargaining since organized labor and business are now so large that what they do affects the public. This ties in with our accepted ideology of a high level economy without inflation.

Other points and predictions offered by the DePaul economist: The national debt can increase each year and yet be a smaller burden on the taxpayer. We can have substantial national deficits without posing a major problem. The long term outlook for the price level is upward—a modest inflation of about 1% per year. A major depression is not in the cards. The government will not allow mass unemployment, even if caused by automation.

Service Shop Weaknesses

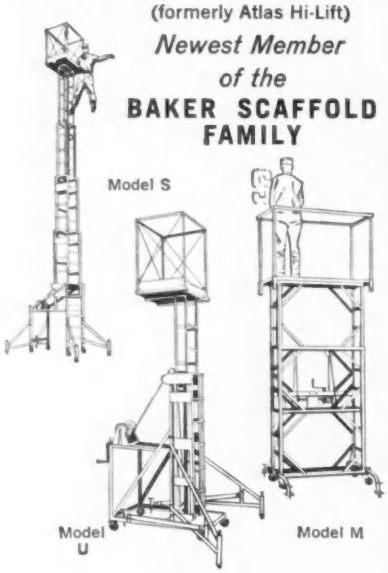
Electrical apparatus service shops are decidedly weak in their marketing and sales efforts, according to Dr. Jack Stanley Wolf, associate professor of marketing, St. Louis University, St. Louis, Mo. Of the shops attending EASA seminars in five cities throughout the U. S., one-third had not assigned anyone to handle their marketing and sales functions; over one-half felt their firms were emphasizing technical functions over sales; and 40% spent less than 15% of their selling time prospecting for new business, Dr. Wolf revealed. Service shops have an advantage over "big" competition if they will get out and promote and sell their availability and flexibility to serve their specific market area and customer needs, he pointed out. Management shortcomings include the following:

WILLIAM LUEBKER president, Central District Chapter, EASA, Chicago, and superintendent, Hyre Electric Co., presides over first session of EASA's 29th Annual Convention in Chicago.



NEW EASA OFFICERS are (L to R): vice president—J. F. Ferrari, Excel Electric Service Co., Chicago; secretary—A. G. Bamford, Sutherland-Schultz Electric Co., Ltd., Kitchener, Ont., Canada; treasurer—W. G. Brush, Electric Motor Service, Inc., Birmingham, Ala.; president—B. J. Horton, The Atkinson Armature Works, Pittsburg, Kansas.

Make
Hard-to-Reach Spots
Easy
with
BAKER
Tele-Scaf
(formerly Atlas Hi-Lift)
Newest Member
of the
BAKER SCAFFOLD
FAMILY



The newest member of the Baker Scaffold family is the Baker Tele-Scaf. Tele-Scaf is made in three models. All three are designed for work at fully extended work heights from 18 feet to 34 feet depending on the model. Baker Tele-Scaf is available either powered or manually operated. You'll be interested in more information on Baker Tele-Scaf models. Write for the new Baker Tele-Scaf Bulletin . . . and see how easy the "hard-to-reach" spots really are.

BAKER
SCAFFOLDS
DESIGNED FOR PORTABILITY • BUILT FOR DURABILITY
BAKER-ROOS, INC.
P. O. Box 892, Dept. 623 Indianapolis 6, Ind.
DISTRIBUTORS IN PRINCIPAL CITIES

KEYNOTE SPEAKER James F. Lincoln, The Lincoln Electric Co., Cleveland, Ohio, tells EASA Convention in Chicago that labor and management must cooperate and increase efficiency if American business is to meet competition of European Common Market.

DR. WM. A. HAYES, chairman, Dept. of Economics, DePaul University, Chicago, predicts more governmental influence in collective bargaining wage settlements in areas where public interest is involved. Hayes addressed the 29th EASA Annual Convention in Chicago.

they are too technically oriented in their business operation; they fail to analyze the local market; they fail to organize their sales function; they fail to become customer-oriented.

To overcome these shortcomings, Dr. Wolf suggested that shops: (1) determine business objectives for a 3- to 5-year period; (2) formulate a plan to achieve those objectives; (3) control and follow up the planned program. Do a little bit extra; be a customer counselor; do not wait to be called in but make yourself known, he concluded.

Get out of the shop and into the front office to manage your business, is the recommendation of Dr. Theodore Haimann, professor, School of Commerce and Finance, St. Louis University, St. Louis, Mo. Speaking on the subject of "Dynamics of Organization," Dr. Haimann stated that management is a full time job and shop operators must be ready and prepared to meet changing times. A manager's functions include: planning; organizing; staffing; directing and supervising; and control of the business operation.

Manage by objectives and you will avoid crises, Dr. Haimann advised. Planning should be based on a background of local economic conditions. Proper organization will leave you with more time to manage. Staff your organization with competent men and delegate authority to them. Supervise the organization through good directives. Set up a control system that will uncover deviations quickly and enable you to see that planned objectives are being reached. Unless a shop operator becomes a manager performing the above functions, there is little likelihood that his business will grow, he warned.

What are the marks of a successful salesman? According to Dr. Edward McFaul, sales specialist, Chicago, a successful salesman is adaptable to change; does not procrastinate; is willing to accept the challenge of a "no" answer; strives to improve his personality; is enthusiastic and listens well; knows how to dramatize his product and how to close a sale.

The function of service shop advertising is not to make direct sales. It makes the shop known and makes it easier for the salesman making his calls, stated William Balsam who has his own advertising firm in Chicago. While most shops running a consistent advertising program spend about 2% of sales, this figure can be misleading. To reach the same market, smaller shops might have to spend a larger percentage of sales, he noted. Best media for service shops to reach local and regional prospects is a direct-by-mail campaign sent to a selected list of maintenance men, purchasing agents and others, Balsam added. A catalog, properly handled, can become a No. 1 sales tool, he noted. Since people read the yellow pages of phone books only when ready to buy, they are a marketing media and not an advertising media in Balsam's estimation.

The basic function of service shop advertising is to establish the shop and its services. Manufacturers' products come second. Shops having a choice in advertising a product should always push the largest profit items, Mr. Balsam advised. Advertising won't do a poorly managed shop any good. Funds should first be spent to plug management gaps and to hire a salesman, he counseled.

A management "brainstorming" session opened the second day of

the convention. Here, delegates had an opportunity to question the previous day's speakers on management problems relating to their specific shop operations. Joining the speakers on the panel were Ohio service shop operators Selden F. High, The Sullivan Electric Co., Cincinnati; and Thomas W. Hannon, Hannon Electric Company, Canton.

Technical Workshop

For those delegates seeking answers to technical problems there was a 3½-hour session during which there was a healthy exchange of information between the audience and a panel of experts. Subjects covered included: fractional and integral horsepower motors, transformers, rectifiers, testing equipment, insulating materials, and controls. Searching questions on efficient repair methods, use of materials and test procedures were asked and answered by those who had solved similar problems in their own shops.

Panel members included the following: C. J. Covington, Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill.; H. W. Reeve, Inland Industrial Electric Service Co., Chicago; Samuel Heller, Consolidated Electric Motor Co., New York; J. W. Biehl, Biehl Electric Co., Chicago; Paul Martin, Northwestern Electric Co., Chicago; Thomas White, Ther Electric and Machine Works, Inc., Chicago; Thomas Schierloh, Delco Products Div., General Motors Corp., Dayton, Ohio; Chester Sudds, Belden Manufacturing Co., Chicago; and Dr. Jack Wilson, Harnischfeger Corp., Milwaukee, Wis.

Speaking on the subject of insu-

WE HAVE GOT to standardize in order to survive, is the prediction of Dr. Jack Wilson, Harnischfeger Corp., Milwaukee, Wis., as he discusses insulating materials during EASA technical workship session at Chicago convention.

LIDSEEN
"Chicago" benders are your BEST BUY

Illustrated:
No. 5100 *for bending ½", ¾" and 1" rigid conduit*

It's designed by Electricians for Electricians!

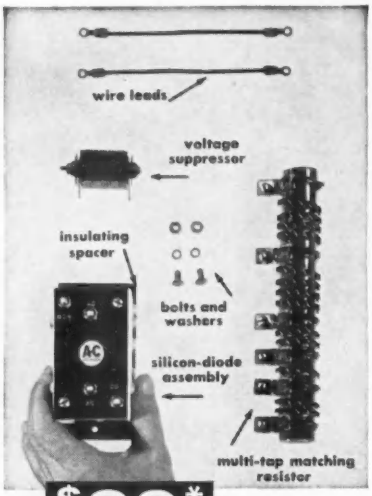
Now! The Lidseen "Chicago" Bender meets the electrician's requirements more than ever. This improved "Chicago" bender incorporates all the additional features that electricians felt could make it the best on-the-job tool. It's lighter in weight, adjusts to any working height, wheels for easier portability and *all* models feature Lidseen's famous calibrated degree scale. **Lidseen "Chicago" Benders are at least twice as fast as hydraulic and work equally well on Aluminum or Steel Conduit.** Remember . . . before you buy just any bender, ask the electrician who is using a "Chicago" Bender; he will tell you it's the finest tool available and at a price that is eminently reasonable.

Bending Circles and Inside Radius

	No. 5100	No. 5300
½" Conduit or Pipe	2⅜"	EMT 4"
¾" Conduit or Pipe	4⅛"	EMT 5"
1" Conduit or Pipe	5¼"	EMT 6"
	No. 5200	**No. 5400**
1¼" Conduit or Pipe	6⅞"	EMT 8"
1½" Conduit or Pipe	8¼"	EMT 10"

Write for NEW Illustrated folder on How to Bend Conduit

LIDSEEN
OF NORTH CAROLINA, INC.
1070 FIRST STREET, HAYESVILLE
NORTH CAROLINA



$99*

silicon-diode rectifier kit eliminates aging resistor in alternating-current operated breakers

This Allis-Chalmers modernization kit *improves* breaker reliability to close at *rated* speed. The kit converts alternating-current operated breakers equipped with copper-oxide rectifiers to silicon-diode rectifiers — where the closing current (E/R value) is 100 amps or less.

The silicon-diode rectifier eliminates need for an aging resistor and its usual periodic adjustment. The silicon unit requires no adjustment or maintenance when properly applied and installed.

The kit also supplies a heavy duty matching resistor to compensate for the resistance of the copper-oxide rectifier removed from the circuit.

One man, in less than 30 minutes, completes the conversion with a screw driver, pliers and a small drill.

Conversion Kit Contains: silicon-diode assembly with insulating spacer, voltage suppressor, two 6" leads, multi-tap matching resistor, mounting nuts, bolts and washers.

*Kit Prices: $99.00 each in quantities of 25 or more; $110.00 each in quantities up to 24 units.

For detailed information, contact your nearest A-C representative or write to **Allis-Chalmers,** *Milwaukee 1, Wisconsin.* A-1646

SUCCESSFUL SALESMEN are adaptable to change, Dr. Edward McFaul sales specialist, Chicago, tells delegates to EASA's 29th Annual Convention in Chicago.

lations, Dr. Wilson noted the constant improvement in silicon and modified silicon materials, polythermal materials and others. There is a need for a universal type of material for insulating magnet wire, slots and insulating varnishes. Chances are good that it will be developed. We have to standardize and reduce insulation inventories to survive, he concluded.

Business Session

At the annual business meeting EASA President George Larsen reported that many shops he visited during his term in office have upgraded their operations. He urged that all service shops upgrade their equipment and physical plant and give prompt attention to ways of increasing customer service.

William J. Wheeler, Sr., chairman of EASA's Small Business Protective Committee, reported that his group is making progress in Washington. Data furnished by the SBPC will be given to the appropriate Senate Committee, he revealed. Delegates were urged to send letters to their legislators calling attention to the small business man's problems and urging support of Senator Sparkman's committee.

EASA Executive Vice President August Baechle noted the success of the basic and advanced EASA Electronic Motor Control Courses. There are no plans for renewal of these courses in the immediate future. With the current emphasis on management problems, EASA will come up with some type of management training program this year, he revealed. With some 80% of the members repairing hand power tools, EASA plans to set up a subcommittee to study this phase of the shop operation, Baechle noted.

EASA Officers

Introduced at the business session were the following new EASA officers: president—B. J. Horton, The Atkinson Armature Works, Pittsburg, Kansas; vice president—J. F. Ferrari, Excel Electric Service Co., Chicago; secretary—A. G. Bamford, Sutherland-Schultz Electric Co., Ltd., Kitchener, Ont., Canada; treasurer—W. G. Brush, Electric Motor Service, Inc., Birmingham, Ala.

50-Year Certificates

At the annual banquet, certificates commemorating 50 years of service in the electrical industry were presented to the following: Aquila Albertson, Sr., Albertson & Son, Red Hill, Pa.; W. E. Barrett, Still's Electric Co., Decatur, Ill.; R. S. Bowser, Salmon Motor Repair Service, Inc., Syracuse, N. Y.; O. H. Caldwell, Caldwell Electric Shop, Waco, Texas; T. A. Converse, Converse-Bickford Electric Co., Inc., Troy, N. Y.; Fay Eads, Hammond Electric Co., Hammond, Ind.; Paul Eifler, Eifler Electric Co., Union City, N. J.; L. O. Elliot, Electric Motor & Transformer Co., Raleigh, N. C.; B. V. Ferrari, Sr., Excel Electric Service Co., Chicago; F. J. Flanders, Flanders Electric Motor Service, Evansville, Ind.; R. T. Hyre, Hyre Electric Co., Chicago; R. S. Johnson, Johnson Electric Co., Pueblo, Colo.; J. U. Kauffman, Kauffman Electric Co., Baltimore, Md.; R. J. Koenig, Koenig Electric Co., Milwaukee, Wis.; H. I. Lamb, Electrical Equipment Co., Richmond, Va.; John E. Launder, Independent Electric Machinery Co., Kansas City, Mo.; M. T. Moore, Industrial Electric Service Co., Kearney, Neb.; Fred Polster, Torq Electric, Cleveland, Ohio; H. A.

PARTICIPATING in floor discussion during EASA Convention technical workshop session in Chicago is Earl S. Brooks, United Electric Motors, Seattle, Wash.

EMPHASIZE your firm's availability and flexibility to serve specific market and customer needs is the advice given EASA delegates to Chicago convention by speaker Dr. Jack Stanley Wolf, associate professor of marketing, St. Louis University, St. Louis, Mo.

Schreck, H. A. Schreck, Inc.; Poughkeepsie, N. Y.; A. S. Tracy, A. S. Tracy, Inc., Concord, N. H.; and L. R. Turner, Turner Electric Service, Ann Arbor, Mich.

Between sessions, EASA registrants visited the exhibit area where products of more than 50 manufacturers were on display. And one morning of the three-day convention was reserved for visits to local service shops.

General chairmen of the Chicago convention were: Robert C. Kaska, Chicago Electric Co.; and Paul M. Sievert, Sievert Electric Co. The 1963 convention is scheduled for Dallas, Texas.

Western Lighting Conferences Reflect Industry Diversity

Three western regional lighting conferences were held by the Illuminating Engineering Society during May; delegates successively convening at Spokane, Wash., the 17th and 18th; at San Diego, Calif., the 21st-23rd, and at Albuquerque, N. M., the 24th and 25th.

At all three meetings Society activities and future plans were reviewed by National President James R. Chambers; Applied Lighting competitions were held to select regional representatives for the national convention in September, and school lighting problems were analyzed by such authorities as Charles D. Gibson, Dept. of School Planning, Calif.; Henry L. Wright, president elect of the AIA; V. M. Charlton, Toronto Board of Education and Ch. of the IES School Task Comm., and C. L. Crouch, IES Technical Director.

Speakers at all three meetings also included John E. Flynn, Gen-

NEW!

POW-R-SPADE®

SELF-PROPELLED TRENCHER

MODEL 7200

Rugged, trouble-free POW-R-SPADE digs down to 6 ft.!

Yes, this larger self-propelled POW-R-SPADE is new . . . to you. But to the engineers and development people at Stampings Inc. it is several years old. During that time this new machine has been severely tested and proved. Now we can offer a larger size POW-R-SPADE confident that it will stand up under toughest digging conditions. Every part is designed and constructed with an extra margin of ruggedness and strength to eliminate breakdown possibilities. Model 7200 digs to 6 ft. deep in widths of 4 and 6 inches; 8 and 12 inch widths to proportional lesser depths.

Built-in towing bar for moving to the job behind car or truck. No trailer is necessary. Four digging speeds up to 15 ft. per minute depending on soil

◀ **AMERICA'S MOST POPULAR LIGHTWEIGHT TRENCHER**

This is the machine that has won the loyalty and respect of users all around the country since its introduction in 1956. Today there are more in use than any other in its class. Recommended for trenching to lay cable, conduit, pipe, tubing where 3" width by 24" depth is sufficient. In the words of satisfied users . . . "a labor saver, easy to operate, and profitable."

Model 1902. Digs 3" wide to 24" deep or 4" wide to 18" deep. Light weight, compact, portable. Digs 1½ to 17 ft. per minute depending on soil conditions. Digs straight, curves, or angles. One man operation from start to finish. Shipped completely assembled.

For Details and Prices

WRITE TO:

STAMPINGS, INC.

Dept. E, Rock Island, Illinois

OR TELEPHONE COLLECT:

Rock Island, Illinois

788-9527

JET SET

makes short work of wiring small conduit!

Money-saving **MUST** for every crew . . . in every truck!

Handy JET SET gives you everything needed to wire any length 1/2", 3/4", or 1" I. D. conduit—and do it faster, safer, for less cost!

JET SET includes: Rigid Rope (for fishing short runs); Jet Line Cylinder (for putting a line through longer runs in seconds), and Poly Rope and Reel (strong and safe for long pulls). All this in a compact, easy-to-carry unit that weighs under 30 pounds!

For every crew, every truck, get JET SET—the most important tool you can carry—*and go!* Write for full information on how JET SET (and the entire Jet Line Method*) can cut your conduit wiring costs up to 70 per cent!

**Patents cover entire Jet Line Method and apparatus*

JET LINE PRODUCTS, INC.
305 Foster Ave.
Charlotte 3, N. C.

FORTY-FIVE YEARS of labor-management in the electrical construction industry in Buffalo, N. Y., was marked by an all-industry dinner there on May 21. Gwilym A. Price (left), chairman of Westinghouse Electric Corp., and Charles H. Pillard, business manager, Local 41, IBEW, hear some historical highlights from Karr Parker, Sr. (right), chairman of the labor committee, Associated Electrical Contractors of Buffalo and president, Buffalo Electric Co.

eral Electric, who variously discussed Coordination of Lighting and Architectural Interests, and How Applications Influence Light Sources, also Robert R. Wylie, Sylvania Electric Products, who reviewed Advanced Infrared Technology and Mercury Vapor Applications. In addition, Dean Morrill, Line Materials Co., spoke at both the Spokane and San Diego meetings on the subject of outdoor lighting.

Stating that the Society now has over 10,000 members in 97 Sections and Chapters, Chambers declared that it was the responsibility of this group to teach, show and lead the public in ways of good illumination, although commercial promotion should not be included as an organization function. He urged greater research to improve and correct existing visual environments, adding that committees are digesting data in many fields of lighting and presenting conclusions in useful form for application by all who work in the field of illumination.

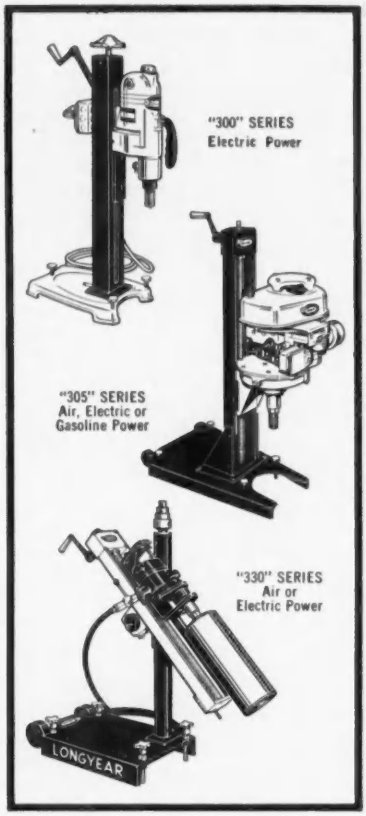
The several sessions on school lighting reviewed relationships between the IES, AIA and National Council for Schoolhouse Construction; these organizations presently cooperating to obtain a strong single lighting program, rather than remaining as three separate groups seeking approximately the same results. Considerable discussion centered around the new IES School Lighting Guide which will replace the former 1948 edition.

In discussing cooperation between architectural and lighting personnel, John Flynn said it is not surprising that various "authorities" with different backgrounds, experience and objectives should differ on what constitutes good lighting. Footcandles are not the only criteria, he maintained, adding that direction, color, contrast, modeling and highlights also contribute to visual impressions, impact and quality vision.

UPSTATERS at Buffalo, N. Y., all-industry gathering, Ray Knoblock, Syracuse electrical contractor and vice president of District No. 1 of NECA, greets Raymond W. Mitchell, Buffalo, who received a gift and testimonial from the New York State Association of Electrical Contractors and Dealers.

Wylie's discussion of infrared technology covered advantages, applications, types of lamps and switching arrangements, operating characteristics, methods for forced cooling and use of closely-spaced lamps for obtaining intense heats (up to 3000 degrees) prescribed for special industrial applications and experimental research work.

Dean Morrill, who reviewed mer-



Indoors or Outdoors... Drill Neat Holes In Any Hard Material

LONGYEAR DIAMOND DRILLS cut clean, straight holes through reinforced concrete, tile, terrazzo, stone, asphalt and glass at rates of up to 3 inches per minute. Holes are nearly perfect—require no patching work.

YOU CAN CHOOSE a Longyear Diamond Drill to fit your exact needs. Air, electric or gasoline power options are available. All drills are extremely portable and ruggedly built. All are backed by more than 70 years experience in the diamond drilling business.

COMPLETE LINE of drilling accessories make Longyear Drills adaptable to almost any drilling situation. Bits range from ¼ inch to 16 inches in diameter. Start now to save yourself time and money by using Longyear Diamond Drilling Equipment.

CONSULT the classified section of your telephone directory under DRILLS for the name of your Longyear Distributor . . . or write us now *for complete information.*

Longyear

E. J. LONGYEAR CO.

76 SO. EIGHT STREET

MINNEAPOLIS 2, MINNESOTA, U.S.A.

Offices in Salt Lake City and major countries throughout the world.

cury and incandescent sources available for both outdoor and interior illumination, pointed out that knowledge by itself is of relatively small value. It is only when knowledge is applied that it becomes truly important.

Referring to increasing lighting standards and decreasing power costs, Morrill said that science, logic and economics dictate higher lighting levels, and that philosophy and psychology should influence us to improve lighting even when economic advantages are absent.

Regional Speakers

Speakers and subjects presented only at the Spokane meeting included O. N. Inguersen, Sola Electric Co., who reviewed effects of heat on ballast life and performance; Consultant Joe M. Doyle, who defined advantages of high voltage lighting systems; also Professor V. Pettibone of Washington State University, who described experiments which related illuminating values to plant growth.

Those who addressed only the San Diego conference included William Shalda, Shalda Mfg. Co., whose topic was lighting the Dodger's new baseball stadium; Jerry Silvers, Globe Illuminating Co., who analyzed high frequency fluorescent installations; Foster K. Sampson, consulting electrical engineer, who reported on commonly encountered glare problems; Rose Coakley, Superior Electric Co., New York City, who discussed control and esthetics of residential lighting; George Gilleard, Day-Brite Lighting, St. Louis, who discussed applications of new products to satisfy modern heating and cooling, and Tom Mendonia, Westinghouse Electric Corp., Bloomfield, N. J., who reviewed methods related to lighting maintenance. Another topic discussed only at San Diego pertained to lighting, heating and cooling equipment contained in integrated ceilings.

In reviewing his ballpark installation, Shalda reported that all existing types of floodlamps and reflectors, plus several new lamps not yet in production had been installed and evaluated before final selections were made for the Dodger stadium.

Jerry Silver's remarks concerning high frequency lighting attracted attention by first asking whether this development was a major breakthrough or an impractical experiment. It was his contention that the truth lies between these extremes, depending upon specific applications. To prove his

ACCENT ON VALUE

6 Circuit

125 ampere load center for $4.00#

You have up to 12 circuits using TWIN* circuit breakers in the new TRP612 load center.

Or put in a 100 ampere 2-pole main breaker and still have enough room for eight lighting circuits.

What a terrific $4.00 buy for the small house or apartment market! Available with or without a door, too. It's another new G.E. product development to make your job easier, more profitable.

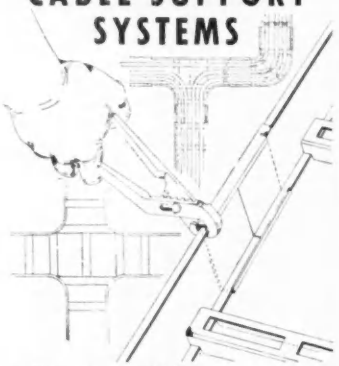
For complete information, call your G-E Distributor today. Or write General Electric Company, Circuit Protective Devices Dept., Plainville, Conn.

* Trade Mark

Manufacturers' recommended resale price

GENERAL ELECTRIC

CUT FIELD LABOR COST 50% with Chalfant CABLE SUPPORT SYSTEMS



4 Reasons Why . . .

. . . You Save Time!

1. All splice plates are factory installed . . . ready for the job.
2. No special tools, jigs, fixtures required . . . just crimp to couple, with channel lock pliers.
3. Splice plates are self aligning.
4. No field drilling needed at point of installation.

Install a quick connecting Chalfant splice plate in one minute. No bolts, nuts, washers, pins or special tools are needed with the Chalfant system for supporting power circuits, process tubing, piping and control cables. Tray is supported on top, bottom and side of channel. Reduce your field labor cost . . . boost your profits and maintain your reputation for good, reliable quality and performance with Chalfant quick connecting tray systems available in aluminized steel, galvanized steel, hot dip galvanized steel, and aluminum. Stainless steel on special order.

WRITE FOR LITERATURE

Chalfant PRODUCTS CO. Inc.

11521 Madison Ave. • Cleveland 2, O.

APPLIED LIGHTING CHAIRMAN Bob Uhl discusses judging procedures at New Mexico meeting with contestant Gordon Hoopman, who won second prize in Residential class for Arizona Section.

On the subject of reflected glare, Foster Sampson cautioned designers on possible misinterpretations of research data, stating that polarization of light can make major contributions to light control although results can vary considerably with different viewing angles.

Control of lighting characteristics such as intensity, color, texture and contrast was analyzed by Rose Coakley who demonstrated how control of illumination in the home could raise or lower conversational pitch and animation, contribute to physical relaxation or stimulation, make rooms appear larger or smaller, warm or cool.

As lighting standards progress upwards they place growing awareness upon heat loads and air conditioning problems, stated George Gilleard; this awareness requiring fixture manufacturers to develop luminaires which combine several functions formerly performed by separate components. He outlined progressive steps in the development of modular fixtures which would serve as air diffusers and exhaust channels, directing room air through lamp and ballast compartments to exhaust plenums.

Gilleard's presentation directly followed a panel discussion on integrated ceilings; this panel being moderated by J. S. Hamel, consulting engineer of Los Angeles, with participants including G. W. Dunn, Frank L. Hope and Associates, San Diego; Tom Medonia, Westinghouse Electric Corp., Bloomfield, N. J.; John E. Flynn, General Electric Co., Cleveland, Ohio, and Gilleard himself.

Speakers appearing only on the New Mexico program included Gene Rae, Holophane; Fred Abrahams, Advance Transformer Co.;

TESTS PROVE:
10% more slip
with Y-ER EAS
Wire Pulling Lubricant
For Lead, Rubber, Braid or Synthetic Covered Cables

There is only one Y-ER EAS

Don't accept substitutes. The extra slip means extra savings on every job.

- Creamy, non-corrosive. Never greasy or messy.
- Prevents sticking or setting. Extra slip for saddles and turns.
- Does not run back on cables.
- Never harmful to hands, clothing, cables or conduit.

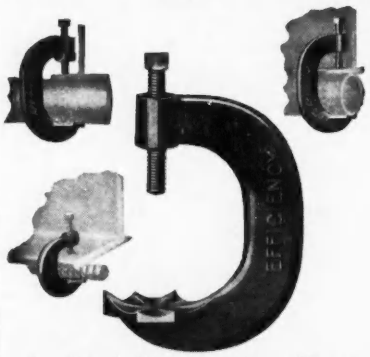
NEW! ALUM-N-EAS
Thread lubricant stops binding of aluminum conduit connections!

Write for descriptive literature

At all Leading Electrical Supply Houses

ELECTRO COMPOUND CO.
4149 W. 150th St., Cleveland 35, Ohio

EFFICIENCY
CONDUIT HANGERS for GAS · CABLE and AIR LINES



On Steel Construction, "Type F" hangers are best for carrying ½ to 2½ pipe and armored cable at any angle to beams.

Write for new catalog

EFFICIENCY
ELECTRIC & MFG. CO.
EAST PALESTINE, OHIO

SAVE TIME! End guesswork with

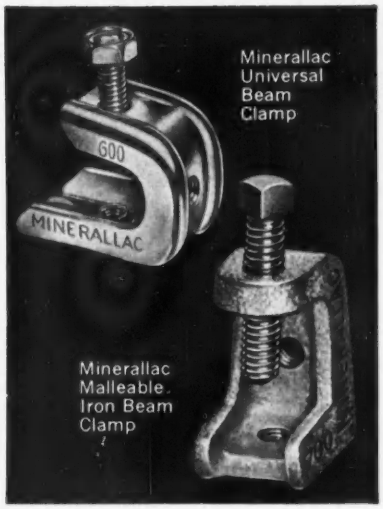
"SIZE-MARKED"

MINERALLAC®

Beam Clamps

Universal Stamped Steel or Malleable Iron

Minerallac is the originator of the Universal Stamped Steel Beam Clamp. Minerallac is the only manufacturer that supplies both Stamped Steel and Malleable Iron types.



MINERALLAC UNIVERSAL BEAM CLAMPS

For mounting Hangers on I-Beams. Mounts Minerallac hangers No. 0 to No. 6 on I-Beams without necessity of drilling holes. Has ¼-20 tapped holes. Fits beam flanges up to ½" thick. Low cost.

MINERALLAC MALLEABLE IRON BEAM CLAMPS

Designed for maximum strength without excess weight. Cadmium plated for maximum rust protection. All sizes have throat openings to accommodate up to ⅞" flange. Set screw tapped at angle to give locking action on beam. NO DRILLING HOLES.

Exclusive Feature!

Each Minerallac fitting is "SIZE-MARKED". All are clearly and individually stamped with its exact size for immediate identification and quick and easy handling. Ends time-consuming guesswork and costly mismatches in the stock room and on the job.

Order from Your Electrical Wholesaler
LITERATURE OR SAMPLE ON REQUEST

MINERALLAC *Electric* COMPANY
ESTABLISHED 1894
25 N. PEORIA STREET • CHICAGO 7, ILLINOIS

Charles Amick, Day-Brite Lighting; Vern Winn, Thomas Industries; Carl Albach, Santa Fe Consulting Engineer; Wallace Weld, Revere Electric; D. L. Copeland, Crouse-Hinds; B. E. Duffy, Westinghouse, and W. W. White, Owen-Corning Fiberglas.

Gene Rae maintained that lighting standards are flexible, increasing with our research and knowledge of practical requirements, and that establishing fixed standards in effect sets lighting limitations. For this reason prescribed levels of illumination should be presented as guides rather than as objectives.

Abrahams' talk on ballasts covered construction and operating characteristics of such commonly used assemblies as instant start, rapid start, preheat, etc.; analyzing temperature rise, potting compounds, fusing methods, dimming provisions and use factors contributing to maximum performance.

In listing benefits of good industrial lighting, Charles Amick contended that we already have the knowledge and tools to produce excellent lighting quantity and quality for fast, accurate, comfortable seeing, although considerable education and promotion still is required before the public realizes that end results justify the expense.

Residential lighting and dimming, as reviewed by Vern Winn, covered such varied methods as recessed and pendant fixtures, chandeliers and adjustable spotlights, luminous ceiling sections and outdoor illuminating sources. Using the same basic enclosures and lamps, Winn showed how lumen output, projection patterns and diffusion can be adjusted by considering various reflector and lens combinations.

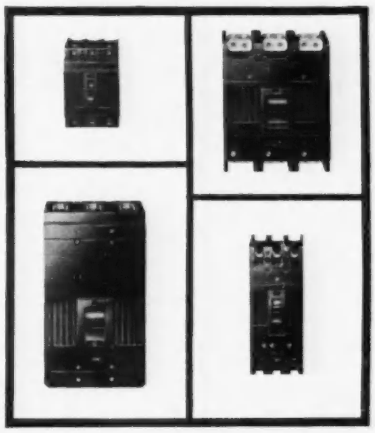
The Allied Arts program was reviewed by Carl Albach, from its

SCHOOL LIGHTING was topic of Charles Gibson of Sacramento, Calif., when he spoke at New Mexico lighting session presided over by Gregg Cloos of Denver, chairman of IES Rocky Mountain Section.

ACCENT ON VALUE

4 FR-ames

to fill your circuit breaker needs from 15 to 1000 amperes



Selection is simplified... only four frame sizes to choose from... new compact size gives increased versatility. New F 225 and J 400 lines feature ambient compensation as standard to eliminate complex derating. Front adjustable magnetic trip for ±10% accuracy at *all* settings, space savings up to 70% over old styles. Another new G-E product development to make your job easier, more profitable.

For complete information call your G-E office or Distributor today. Or write General Electric Company, Circuit Protective Devices Dept., Plainville, Conn.

GENERAL ELECTRIC

- King Size capacities
- Digs to 5½' deep - 18" wide with no costly changeover
- Reversible conveyor - deposits dirt on either side of trench - no spill back.
- Absolutely straight - line trenches - no side thrust.
- Fingertip control - you see trenching progress at all times.
- Accurate depths via precision hydraulic control valve.
- Safety transport lever forward or reverse movement without gear shifting - no accidental "runaway".
- 46,000# tensile strength chain compared to 28,000# of competitive units.

Better than Ever ... and Any!

ARPS MODEL L-12
TRENCH DEVIL

Write for free brochure detailing the ARPS L-12 Trench Devil or Model M-A2 Trench Devil for smaller capacities

ARPS CORPORATION DEPT. CM
NEW HOLSTEIN, WISCONSIN
Trenchers • Half-Tracks • Dozers • Utility Blades

NEW Convenient Wall Chart Saves Time in Selecting Wire Sizes

Gives Carrying Capacities of Copper and Aluminum Conductors in Raceways or Cables

For engineers, estimators or other electrical planners, a huge wall chart features the NEC carrying capacities of popular sizes and types of aluminum and copper conductors—all on one easy-to-read table. Also included are important code notes concerning the application of the data.

Order your wall chart today. It's designed to save you valuable time.

PRINTED ON TOUGH TEXOPRINT
IN 2-COLORS
IT'S BIG
23" x 35"
PRICE $1.00

USE THIS COUPON TO ORDER

PLEASE PRINT

Electrical Construction and Maintenance
330 West 42nd Street, New York 36, N. Y.

Please send me ..... wall chart(s) at $1 each

☐ Payment enclosed. ☐ Please bill me. ☐ Bill Company.

Ship to:
Name _____ Title _____
Company Name _____
Address — Home ☐ Company ☐ _____
City _____ Zone _____ State _____

(700-159-010.2)

Beaux Arts beginning to present endorsement by the IES, AIA and the Society of Industrial Design.

Weld, Copeland and Duffey, respectively, dicussed sports, area and freeway lighting concepts, collectively reviewed new lighting sources and fixtures available for these applications. The speakers presented slides to illustrate methods of mounting and aiming.

The final speaker at Albuquerque, W. W. White, considered advantages of light polarization panels. Referring to Blackwell's recommendations on this subject, White reminded delegates that this research had been a critical inquiry of seeing difficulties under laboratory conditions; indicating that polarization can minimize glare, reveal colors more truly and obtain equal seeing effectiveness under lower lighting levels. White's discussion covered polarizing mediums such as multi-layer sheets of film; polarizing methods such as reflection, refraction and absorption, and polarizing types such as radial, elliptical, circular and lineal.

Applied Lighting

The Applied Lighting competition at San Diego resulted in first, second and third place awards in the Residential division going respectively to W. G. Anderson, Arrowhead Section; Norman P. Tylon, Southern Calif., and L. B. Craig, Diablo Section. In the Commercial-Industrial class, first prize went to collaborators James Hicks and Ray Stalk, Arrowhead, with second place going to Bruce Thyberg, San Diego consulting engineer. Third place award was also a joint-effort project; Consultants Carl Long, Lawrence Eyer and Scott Beamer obtaining recognition for the Diablo Section. This contest was directed by Joe Wood of San Francisco, assisted by Rollie L. Camren and Robert J. Huff of San Diego.

At Albuquerque, Residential contest winners were: first, Vivian Hamilton, El Paso Chapter; second, Gordon Hoopman, Arizona; third, Stan Johnson, N. M. Awards in the Commercial-Industrial division went to: first, Claude Buckley, Jr., El Paso; second, Tony Royball, N. M.; third, Don Peterson, Utah; honorable mention, Bill Keller, Ariz.

These three regional conferences were directed by Ray Rookey at Spokane; Ralph W. Rohrbach and Alan J. McCutcheon, Jr., at San Diego; A. W. Boehning, Jr., and Stan Johnson at Albuquerque.

Pretty receptionist flips *Sno-Melter* switch; clears snow from shipping docks, truck ramps, walks!

Shall we hold a wake for the old snow shovel? The modern snow removal system—Sno-Melter—operates at the flip of an electric switch. Operates economically, too, because warm-up and melt-off time are far faster than with any heated liquid system.

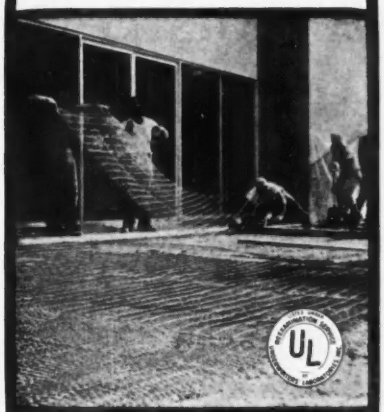
Constructive way to use spare electrical capacity which is freed when air conditioning goes off!

Installation? Compare the old method of laying a maze of circulating pipes, with a modern Sno-Melter. This system incorporates pre-spaced, anchored resistance wire in mats which roll out like rugs as concrete is poured.

Standard sizes cover 4 to 90 square feet—dissipate either 42 or 60 watts of uniformly even heat per. Other sizes on special order.

Now, firms whose truckers used to spin their wheels every winter can start them out on solid ground. A company's customers will always find a clear path to its dock. And maintenance crews, with no more snow to shovel, nor ice to chop, can be more productive.

Better get the facts on Sno-Melter on file; you're going to want to recommend it. Write for detailed 4-page folder.



EASY-HEAT INC.

"Electric Snow Removal Equipment"

Dept ECM New Carlisle, Ind.

DATES AHEAD

Western Electronic Show & Convention—Memorial Sports Arena, Los Angeles, Calif., August 21-24.

American Home Lighting Fixtures Month—National promotion, September 1-30.

Illuminating Engineering Society—National technical conference, Statler-Hilton Hotel, Dallas, Texas, September 9-14.

Canadian Electrical Mfrs. Assn.—Annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., October 3-5.

International Assn. of Electrical Leagues — 27th annual conference, Sheraton-Chicago, Chicago, Ill., October 3-5.

National Electrical Contractors Assn. — Minneapolis Auditorium, Minneapolis, Minn., October 7-13.

National Electronics Conference—McCormick Place, Chicago, Ill., October 8-10.

Rocky Mountain Electrical League—Fall convention, The Broadmoor, Colorado Springs, Colorado, October 14-18.

International Association of Electrical Inspectors — Chapter Meetings — **Southern Section**, Tutwiler Hotel, Birmingham, Ala., October 15-17.

Materials Handling in Canada Exposition—Automotive Bldg., Exhibition Park, Toronto, Canada, October 15-18.

Florida Association of Electrical Contractors—Annual conference (no trade show), Castaway's Motel, Daytona Beach, Fla., October 18-20.

Electrical Manufacturers Trade Show —Indiana State Fair Grounds, Indianapolis, Ind., October 23-25.

National Electrical Manufacturers Assn. — Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

Electrical & Home Appliance Show—Balboa Park, San Diego, Calif., November 23-28.

Building Research Institute—Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

Electrical Engineering Exposition — Sponsored by AIEE, Coliseum, New York, N. Y., January 28-31, 1963.

16th International Heating & Air Conditioning Exposition—Coliseum, New York, N. Y., February 11-14.

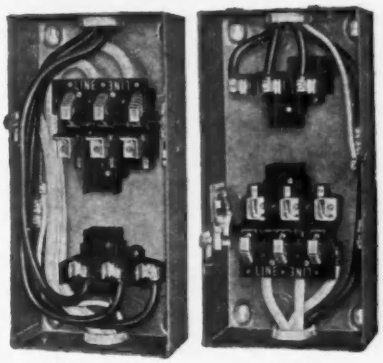
Associated General Contractors of America—44th annual convention, Americana Hotel, New York, N.Y., March 4-7.

4th Southeastern Plant Engineering and Maintenance Exposition — Merchandise Mart, Charlotte, N. C., March 5-7.

ACCENT ON VALUE

RE-vers-IBle

Safety Switches can save you up to $30.00 on cable cost



The Old Way — The G-E Way

The G-E way to wire safety switches with incoming lines at bottom saves you money on cable costs. No more wasted time with looping cables inside box. No more danger of wire abrasion. ON-OFF indication is the same as before. Available with line lugs factory installed at bottom, or for field installation. Another new G-E product development to make your job easier, more profitable.

For complete information call your G-E Distributor today. Or write General Electric Company, Circuit Protective Devices Department, Plainville, Conn.

GENERAL ELECTRIC

For Linemen—Electricians

KLEIN

"CUSTOM" CUSHION GRIP SCREWDRIVER

Slotted amber plastic handle and interlocking ribbed sleeve of Nitrile rubber assure 50% greater torque.

Designed for electricians and mechanics who want something better than the usual commercial screwdriver. Exceptionally strong, made of alloy tool steel carefully heat-treated. Full chrome-plated finish. Plastic handle is shockproof and nonflammable. Nitrile rubber grip is resistant to oil, gas and water. Square shank and round shank types, with blade for either slotted screw or Phillips head. Write for Bulletin 1261.

Foreign Distributor:
International Standard Electric Corp., New York

Mathias Klein & Sons
Established 1857 — Chicago, Ill., U.S.A.
INCORPORATED
7200 McCORMICK ROAD, CHICAGO 45, ILL.

Among the Manufacturers

Headquarters Announcements

International Harvester Co., Chicago, Ill.—Harry O. Bercher, president and chief executive officer.

General Electric Co., Schenectady, N. Y.—Lawrence L. Dengler, manager of marketing, Outdoor Lighting Dept.

Moloney Electric Co., St. Louis, Mo.—R. S. Anderson, sales engineer, Switchgear Div.

Thomas & Betts Co., Elizabeth, N. J.—Robert M. Thomas, Jr., senior vice president and general manager.

Shalda Mfg. Co., Inc., Burbank, Calif.—William H. H. Reeder, sales manager.

Litecraft Industries, Ltd., Passaic, N. J.—Allan W. Larson, vice president of marketing and director.

Worthington Corp., Harrison, N. J.—Robert S. Sherwood, general manager, Advanced Products Div.

Oak Mfg. Co., Crystal Lake, Ill.—Ira M. Rosenthal, chief industrial engineer.

Appleton Electric Co., Chicago, Ill.—Phillips M. Darby, vice president of sales.

B. A. Wesche Electric Co., Cincinnati, Ohio—Joe St. Andre, chief application engineer.

Western Semiconductors, Inc., Santa Ana, Calif.—Forest K. Milham, manufacturing manager; Ed Silfen, director of reliability and quality control.

Yale & Towne Mfg. Co., New York, N. Y.—Paul R. Hartig, vice president of materials handling; Roy L. Wolter, vice president.

Kaiser Aluminum & Chemical Corp., Oakland, Calif.—F. S. Bartlett, national manager of executive accounts, Electrical Products Div.

General Electric Co., Plainville, Conn.—Samuel L. House, manager of product planning, Circuit Protective Devices Dept.

S&C Electric Co., Chicago, Ill.—Philip J. McLaughlin, vice president of sales.

Triangle Conduit & Cable Co., New Brunswick, N. J.—John F. McKiernan, director of sales, Power Cable Div.

Wej-it Expansion Products, Inc., Stamford, Conn.—A. J. McEwan, vice president for sales and marketing.

Tann Corp., Detroit, Mich.—A.

LOW COST Protection!
KATOLIGHT
STANDBY POWER
Gasoline, Gas Diesel Models to 750 KVA
We all agree it is good business to insure against unforeseen losses due to fire, wind or accident . . . but none is available to cover loss of time, inconvenience, discomfort, dangers that power failures bring. With Katolight Power Plants you can keep your electrical equipment functioning until power is restored.
SPEEDS WORK! Low Cost!
KATOLIGHT
PORTABLE POWER
AVAILABLE ON DOLLIES OR TRAILERS
Crews have "plug-in" power at their finger tips when and where they want it. Quick, steady power for operating electric saws, grinders, drills, hammers, heaters, sanders, paint sprayers. No delays. No nuisance power line hook-ups. 500 to 35,000 watts and up.
BIGGER OVERLOAD CAPACITY
WRITE FOR
NEW BROCHURE!
Katolight CORPORATION
Box 891-53 Mankato, Minnesota

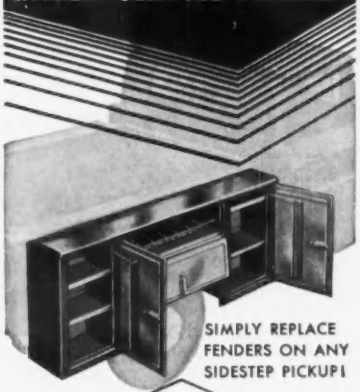
Answers the need for a Sturdy, Strong Staple. Save Time, Labor, Material with these rugged Thiel Staples.

Sold by Leading Electrical Wholesalers
Send for FREE Samples

•

THIEL TOOL AND ENGINEERING COMPANY
1417 N. Market St. • St. Louis 6, Mo.

PC TOOL COMPARTMENTS
CONVERTS ANY PICKUP INTO A MONEY SAVING, ROOMY, EFFICIENT SERVICE VEHICLE!



SIMPLY REPLACE FENDERS ON ANY SIDESTEP PICKUP!

For Complete Information and the Name of the Distributor Nearest You . . . Call or Write:

UTILITY BODY CO.
1530 WOOD STREET • OAKLAND, CALIF.
TWinoaks 3-8980

TRADE ARRO MARK

Quality-Service Since 1930

A broad line of Masonry Fasteners and Masonry Drilling Devices

See your nearest Distributor or write

ARRO EXPANSION BOLT CO.
P. O. Box 388, Marion, Ohio

F. Williams, sales manager, Tann Controls Co. Div.

General Electric Co., Niles, Ohio —Anthony J. Gizzi, manager of marketing and engineering, Conduit Products Dept., Chemical and Metallurgical Div.

Malleable Iron Fittings Co., Branford, Conn.—Robert E. S. Thompson, president and general manager; Albert S. Fehsenfeld, executive vice president; T. F. Hammer, chairman of the board.

Marvin Electric Mfg. Co., Los Angeles, Calif.—John Lomeli, advertising and merchandising director.

Progress Mfg. Co., Inc., Philadelphia, Pa.—Arthur C. Kaufmann, director.

Steel City Electric Co., Pittsburgh, Pa.—Frank E. Rickel, director of marketing.

Black and Decker Mfg. Co., Towson, Md.—William H. Drews, advertising and sales promotion manager.

Sylvania Electric Products Inc., Salem, Mass.—Roy E. Bevan, product manager, mercury and fluorescent lamps, Lighting Products Div.

Wakefield Corp., Cleveland, Ohio —J. William Steiner, president and general manager, Art Metal Lighting Div.

J. I. Case Co., Racine, Wis.—Raymond J. Miller, vice president of engineering.

Edwin L. Wiegand Co., Pittsburgh, Pa.—C. Frederick Kreiser, vice president of marketing; G. Edward Ammerman, vice president of sales of subsidiary, Chromalox, Inc., Murfreesboro, Tenn.; Stephen Campanella, general sales manager; Werner S. Eyth, industrial sales manager.

Kliegl Bros., New York, N. Y.—Joel E. Rubin, vice president.

Union Metal Mfg. Co., Canton, Ohio—S. J. Garland, manager of sales promotion.

Pyle-National Co., Chicago, Ill. —Jack F. Shearer, vice president.

Pendar, Inc., Van Nuys, Calif.—Allan C. Billings, sales engineer.

Regional Appointments

NEW ENGLAND

Federal Pacific Electric Co.: A. E. Carpluk, Northeast regional sales manager for eastern New York state and New England with headquarters at Norwood, Mass.

Dow Corning Corp.: Ray S. Naegele, manager, Boston sales office.

General Electric Co.: G. Herbert Ferriter, Jr., sales representative of consumer sales of New England area headquartered in New York

IDEAL

HAS EVERYTHING YOU NEED FOR MOTOR AND COMMUTATOR MAINTENANCE

KEEP YOUR D.C. MOTORS RUNNING LONGER AT LOWER COST

Write for Free Motor Maintenance Catalog, NOW

IDEAL INDUSTRIES, Inc. (IDEAL)
1041-G Park Avenue, Sycamore, Ill.
Send me Motor Maintenance Catalog.
Name_____
Company_____
Address_____
City_____ Zone____ State_____
SOLD THRU AMERICA'S LEADING DISTRIBUTORS

QUAD
REFLECTORS

4 Simple Steps to Good Lighting..

1 • Attach QUAD Swivel Aligner to outlet box.

2 • Add one piece of conduit cut to desired length.

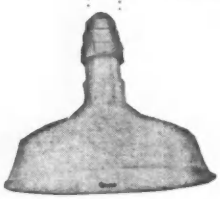
3 • Thread on QUAD REFLECTOR of your choice.

4 • Install lamp of suitable wattage.

example:

QUAD. No. 145G

CONDUIT AND WIRE BY OTHERS



QUAD No. 1168V 200W

Porcelain Enamel Finish

Take Your Q From

QUAD

Complete line of many shapes, sizes and choice of socket fittings

★ Write for Catalog No. 10

QUADRANGLE MFG. CO.

32 S. Peoria Street

CHICAGO 7, ILLINOIS

Member RLM

City; S. Alfred Richards, manager of consumer sales, headquartered in Providence, R. I.; Wiring Device Dept.

Minneapolis-Honeywell Regulator Co.: Calvin S. Herrala, director of service engineering, Boston Div.

MIDDLE ATLANTIC

Consolidated Pipe Co. of America: Joseph R. Porillo, Electrical Sales Agents, Inc., Syracuse, N. Y., sales representative for New York state; Paul F. Gallagher, Philadelphia, sales representative for eastern Pennsylvania and southern New Jersey.

Dow Corning Corp.: Norton C. Foster, manager of New York sales office.

Murray Mfg. Corp.: Robert C. Eden, representative for eastern Pennsylvania with headquarters in Philadelphia.

Hykon Mfg. Co.: Arthur E. Peabody, Albany, N. Y., representative for upper northeastern New York state.

Crucible Steel Co. of America: John G. Gill, manager of Midland, Pa., Works.

Youngstown Sheet and Tube Co.: Charles E. Hall, Buffalo district sales manager.

General Electric Co.: Raymond J. McCormick, manager of consumer eastern district sales with headquarters in New York, Wiring Device Dept.; James G. Walton, manager of northeastern sales region with headquarters in Liverpool, N. Y., Semiconductor Products Dept.

SOUTH ATLANTIC

Dow Corning Corp.: Robert E. Bright, manager of Washington sales office.

Thomas Industries Inc.: James A. Henson, sales representative in South Carolina with offices in Columbia; Lighting Div.

EAST CENTRAL

General Electric Co.: Robert J. Diefenthaler, manager of East Central sales region with headquarters in Cleveland, Ohio, Large Lamp Dept.; Basil Banko, manager of consumer western district sales; Robert G. Wallace, sales representative of consumer sales; both located in Chicago; Wiring Device Dept.

Feedrail Corp.: K. E. Eggenspiller & Associates, Anchorage, Ky., representative.

Youngstown Sheet and Tube Co.: Charles B. Halle, district sales manager of Columbus, Ohio.

PHONE FOR MILES
without any current

Depending upon the wire used, Sound Powered Telephones will operate from short distances up to 30 miles or more without batteries or other power sources. Your voice supplies the energy to transmit speech in clear, distinct tones, free of all static. Indoor and outdoor models.

Write for catalog

HOSE-McCANN TELEPHONE CO., INC.

25th St. & 3rd Ave., Brooklyn 32, N.Y.

NEW SUBSCRIPTION ORDERFORM

ELECTRICAL CONSTRUCTION & MAINTENANCE
330 West 42nd Street,
New York 36, N. Y.

Please enter my personal subscription to start as soon as possible:

☐ $3.00 enclosed for one years*

☐ Send invoice

Please Print

Name .....

Title or Position .....

Address—Home ☐ Company ☐ .....

City ..... Zone....

State .....

Company Name .....

Nature of Company's Business .....

I am in charge of elec. work—Yes ☐ No ☐

Operate a motor repair shop—Yes ☐ No ☐

* *Above rates good only in U. S. Please write for rates in other countries.*

NOW IN BOOK FORM

To help you solve problems of product selection–a master reference–complete, modern, illustrated in color!

SELECTING ELECTRICAL EQUIPMENT

by J. F. McPartland and the Editors of Electrical Construction and Maintenance

This book is a modern, comprehensive manual on the selection and application of equipment for electrical power, lighting, heating, signal and communication systems. The complete, original May 1962 feature section of Electrical Construction and Maintenance is now ready. Covering generic types and models of equipment, this volume discusses construction and operation of equipment as they relate to the task of selecting the right device for any job. The presentation includes NATIONAL ELECTRICAL CODE DATA and selection information based on data from NEMA STANDARDS and UNDERWRITERS' LABS.

Chapters in the book are fully and colorfully illustrated to explain quickly and clearly the many details upon which equipment selection should be based.

For the first time here is a manual which organizes into practical, usable form the key product selection facts which are available otherwise only on a hit-or-miss basis.

PLEASE PRINT

"SELECTING ELECTRICAL EQUIPMENT"
Electrical Construction and Maintenance
330 West 42nd Street, New York 36, N. Y.

Please send me ..... copy (copies) of the new book "Selecting Electrical Equipment" at $5.00 each. (10-24 copies @ $4.75 each; 25 or more copies @ $4.50 each)

☐ Payment enclosed. ☐ Please bill me. ☐ Bill Company.

Ship to:
Name .....
Company Name ..... Title .....
Home ☐ .....
Address — Company ☐ .....
City ..... Zone ..... State .....
Please indicate nature of Co. business .....

(273-076)

Consolidated Pipe Co. of America: Forrest O. Durnal, Electric Sales, Muncie, Ind., sales representative for Indiana.

Dayco Corp.: James Walker, Jr., district manager of Alabama with headquarters in Birmingham; Industrial Sales Dept., Rubber Products Div.

Union Carbide Plastics Co.: Maurice T. Bolmer, Jr., regional manager in the North-Central sales region located at Cleveland, Ohio.

Siegler Corp.: Gerald B. Smith, manager of sales, southeast district, with headquarters in Dayton, Ohio; Jack & Heintz Div.

WEST CENTRAL

Consolidated Pipe Co. of America: E. W. Carlson, F-C Sales Agency, Monroe, La., sales representative for Louisiana.

Thomas Industries Inc.: John E. Kussmann, sales representative in Louisiana and Mississippi with headquarters in New Orleans; Lighting Div.

Whitney Blake Co.: Bill Williams, sales representative located at Dallas, Texas, district office.

John C. Virden Co.: William K. Newell, sales representative for Kansas City and St. Joseph, Mo.

WEST

Anderson Electric Corp.: James E. Austin, district manager in Los Angeles.

Murray Mfg. Corp.: Joe Schermerhorn, sales representative with headquarters in Los Angeles; Paul H. Robertson, sales representative for northern California with headquarters in San Francisco.

Champion Lamp Works: N. L. Roup Agency, Denver, sales representative in Colorado and Wyoming.

Air Space Devices: Production Metals, Portland, Ore., sales representative for Oregon and Washington; Ingalls Associates, Oakland, Calif., sales representative for northern California and northwestern Nevada; J. E. Edstrom, Portland, sales representative for public utilities in Oregon, Washington, Montana, Idaho and Wyoming; Safety Tower Ladder Div.

Dayco Corp.: Richard Cooper, district manager of Los Angeles; Industrial Sales Dept., Rubber Products Div.

Consolidated Pipe Co. of America: Krieger-Koufax Co., Los Angeles, sales representative for southern California south of Fresno.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT • BUSINESS
EQUIPMENT — USED OR RESALE
OPPORTUNITIES

DISPLAYED RATE

EQUIPMENT & BUSINESS OPPORTUNITY
Advertising $24.35 per inch.

EMPLOYMENT OPPORTUNITIES—$32.60 per inch, subject to Agency Commission.

An advertising inch is measured 7/8" vertically on one column, 3 columns—30 inches—to a page.

UNDISPLAYED RATE

(Not available for equipment advertising)
$2.40 a line, minimum 3 lines.

POSITIONS WANTED undisplayed rate is one-half of above rate, payable in advance.

Box Numbers—Count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

ELECTRICAL ENGINEERS

Field positions open for transmission, distribution and substation engineers, experienced or recently graduated. Also opening in General Office for electrical engineer experienced in the overall planning and designing of distribution systems. Very good opportunity for advancement. Starting salary commensurate with experience. Excellent benefit program. Send resume to

J. L. Lisenbee, Employment Supervisor
CENTRAL ILLINOIS PUBLIC SERVICE COMPANY
Room 926
607 East Adams Street, Springfield, Illinois
An equal opportunity employer

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 645 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

SELLING OPPORTUNITY AVAILABLE

Representatives Wanted — Select territory open. Well known nationally advertised fastener line, requires representatives because of policy change. Contact RW-8757, Electrical Construction & Maintenance.

POSITION WANTED

Electrical Engineer—46, BS-EE, 20 yrs. experience in Electrical design, construction and operations with industry, consulting engineering firms and electrical contractors. Family man—fluent Spanish-English. All replies answered. PW-9185, Electrical Construction & Maintenance.

BUSINESS OPPORTUNITY

Will Invest—Experienced Sales and Marketing Mgr. wishes to invest and participate in a small to medium size company. 20 yrs. background in elec. trade. 10 yrs. of national sales management. Open to complete investigation. BO-9226, Electrical Construction & Maintenance.

WIRE and CABLE WHEN YOU NEED IT
From Chicago you can get immediate delivery on all types of Electric Cable. Order today. We ship same day.
Send for our latest stock sheet
UNIVERSAL WIRE & CABLE COMPANY
2919 N. Paulina St. Chicago 13, Ill.
Branches: Los Angeles—Houston—Denver

Advertising In This Issue

Adam Electric Co., Frank 13
Advance Transformer Co. 75
Albertson & Co., Inc. 190, 191
Allen-Bradley Co. 193, 194
• Allis-Chalmers Mfg. Co. 71, 206
• All-Steel Equipment, Inc., Raco Div. 55
American Telephone & Telegraph Co. .. 30
Amprobe Instrument Corp.
Amprobe Div. 176
• Anaconda Metal Hose Div., Anaconda American Brass Co. 199
Anaconda Wire & Cable Co. 32
Anderson Electric Corp. 165
Appleton Electric Co. 2
Armco Steel Corp. 82
Arps Corp. 212
• Arro Expansion Bolt Co. 215
Auth Electric Co., Inc. 68
• Automatic Switch Co. 70

Baker-Roos, Inc. 204
Bell Telephone System 30
• Biddle Co., James G. 164
Black & Decker Mfg. Co., The 149
• Blackhawk Industries 198
• Briegel Method Tool Co. 64
• Buchanan Electrical Products Corp., a Subsidiary of ESNA 162
BullDog Electric Products Division I-T-E Circuit Breaker Co. 86, 154
Burndy Corp. 49
Bussmann Mfg. Co. 56, 57

Certified Ballast Mfgrs. 48
• Chalfant Products Co., Inc. 210
Champion DeArment Tool Co. 175
Champion Lamp Works 16
Circle Wire & Cable, a Subsidiary of Cerro Corp. 24
Clark Controller Co., The 60
Clipper Mfg. Co. 62
Cornish Wire Co. 181
• Crouse-Hinds Co. .....Fourth Cover
• Cutler-Hammer, Inc. ..14, 15, 44, 45, 135 136, 137, 138

• Diamond Expansion Bolt Co. 200
Dodge Corp., F. W. 74
• Dongan Electric Mfg. Co. 160
Dow Corning Corp. 4
du Pont de Nemours & Co., Inc., E. I. 61
Dymo Industries, Inc. 9

Easy-Heat Inc. 213
• Efficiency Electric & Mfg. Co. 210
Electrical Construction & Maintenance. 212 216, 217
Electri-Flex Co. 146
• Electro Compound Co. 210
Electromode Div., Commercial Controls Corp. 189
Erico Products, Inc. 182

General Electric Co. ...31, 46, 47, 63, 172
Circuit Protective Devices Dept. 209 211, 213
Lamp Div. 80, 81
Silicone Products Dept. 161
Wiring Device Dept. 186, 187
Goodrich Chemical Co., B. F. 140, 141
• Graybar Electric Co., Inc. 10, 11
Greenlee Tool Co. 17, 18, 19, 20
Guardian Light Co. 144
Guth Co., Edwin F., The ....Second Cover

Henderson-Hazel Corp. 159
Holophane Co. Inc. 26, 27

• Hose-McCann Telephone Co., Inc. 216
• Hubbell Inc., Harvey 174

• Ideal Industries, Inc. 6, 43, 201, 215
I-T-E Circuit Breaker Co., Walker Div. 143, 197

Jet Line Products Inc. 208
Johns-Manville, Dutch Brand Div. 54
Joy Mfg. Co. 168

Kaiser Aluminum & Chemical Corp. .. 84
Katolight Corp. 214
Kidde Ultrasonic & Detective Alarms Div., Walter Kidde & Co. 148
• Killark Electric Mfg. Co. 58, 59
• Klein & Sons, Mathias 214
Kraloy Chemtrol Co. 142

Leviton Mfg. Co., Inc. 78
Lidseen of North Carolina, Inc. 205
Line Material Industries 52, 53
Longyear Co., E. J. 209

• M & W Electric Mfg. Co., Inc. 196
• Mineralac Electric Co. 211
Minneapolis-Honeywell Regulator Co. . 12
Multi-Amp Electronic Corp. 200

National Price Service 159

Orangeburg Mfg. Co. 36

Paragon Electric So., Inc. 180
Pass & Seymour, Inc. 184
Penn Controls, Inc. 166
• PLM Products Inc. 188
Plymouth Rubber Co., Inc. 33
Pyle-National Co., The 35

• Quadrangle Mfg. Co. 216

Ramset Fastening System 37
Republic Steel Corp. 178, 179
Revere Electric Mfg. Co. 38
Reynolds Metals Co. 66, 67

Ridge Tool Co., The 169, 171, 173
Rodale Mfg. Co., Inc. 83
Rohm & Haas 21
• Rome Cable Div. of Alcoa 28, 29, 170
Royal Electric Corp. 69

Safway Steel Products, Inc. 196
• Sierra Electric Corp. 158
Simplex Wire & Cable 79
Skil Corp. 145
Sola Electric Co., Div. of Basic Products Corp. 65
Square D Co. .....Third Cover, 1, 23
Stampings, Inc. 207
Stanley Works, The, Power Tool Div. . 195
Steel & Tubes Div. 178, 179
• Steel City Electric Co. 22
Sylvania Electric Products Inc. 50, 51

• Thiel Tool & Engineering Co., Inc. 214
Thomas & Betts Co. 183
• Triangle Conduit & Cable Co., Inc. .. 77

Union Insulating Co. 8
• U. S. Electrical Motors 198
U. S. Rubber, Naugatuck Chemical Div. 73
Up-Right Scaffolds Co. 72
Utility Body Co. 215

Wagner Electric Corp. 192
• Weaver Co., J. A. 25
Western Insulated Wire Co. 167
Westinghouse Electric Corp. 34, 76, 150 151, 152, 153, 163, 202
Wide-Lite Corp. 147
• Wiremold Co. 39, 40, 41, 42

■

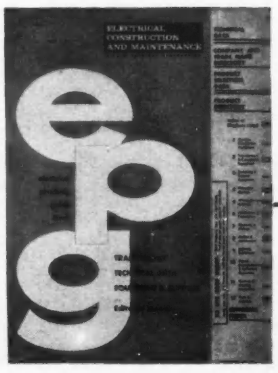
CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES .. 217

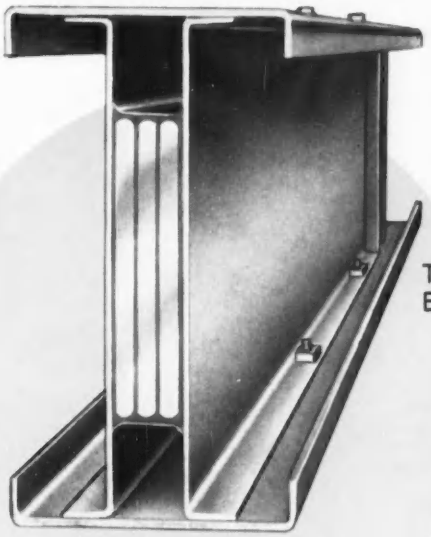
BUSINESS OPPORTUNITIES 217

EQUIPMENT
(Used or Surplus New)
WANTED 217



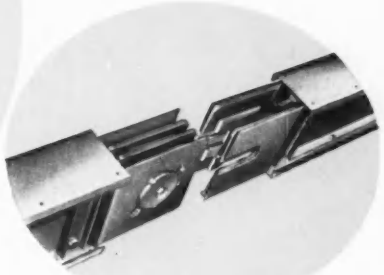
• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

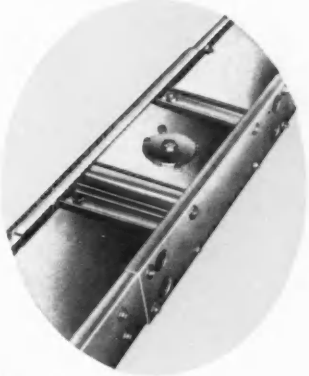
For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.



Here's a real labor cost reducer -on 2 counts ☆

Totally Enclosed
Epoxy Encapsulated





SQUARE D's NEW I-LINE FEEDER DUCT is the finest ever built!

On EVERY Basis of Comparison—

- √ Lowest Reactance
- √ Highest Short Circuit Rating
- √ Most Compact
- √ Lightest ← ☆
- √ Most Versatile
- √ Easiest to Install ← ☆
- √ 800 amp to 4000 amp

write for Feeder Duct Data Bulletin
Square D Company, Mercer Road, Lexington, Kentucky

SQUARE D COMPANY

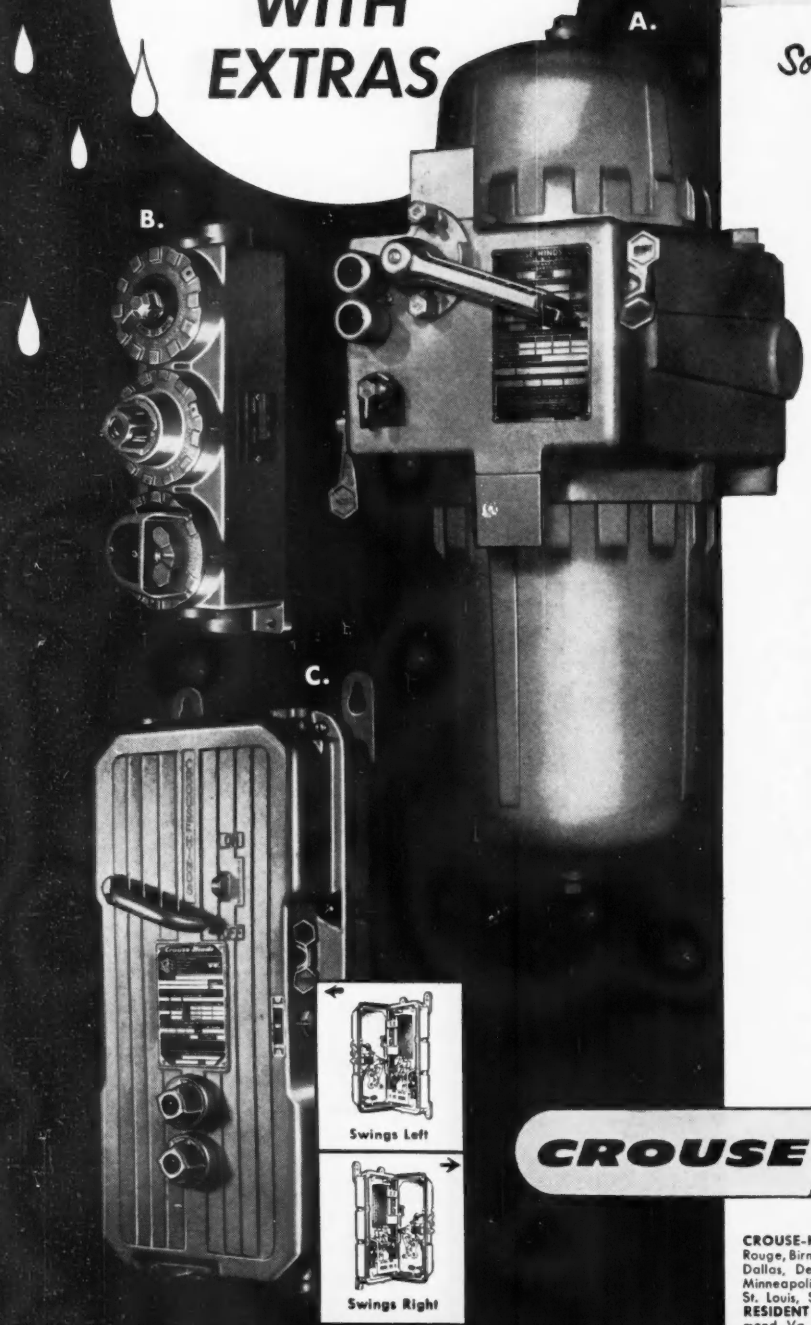
wherever electricity is distributed and controlled

CROUSE-HINDS MOTOR CONTROLS

EXPLOSION-PROOF—DUST-IGNITION-PROOF—WATERTIGHT-RAINTIGHT

ENGINEERED WITH EXTRAS

For hazardous areas, special purpose applications . . . the Crouse-Hinds selection of Motor Controls is unmatched. These controls are designed with extra features that make them adaptable to even the most difficult locations.



Some examples:

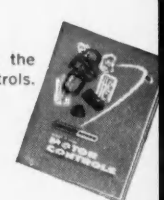
A. This EPC Combination Line Starter Enclosure has effective water-shedding construction with female threads in the top cover, male threads in the bottom cover. It provides for extra conduit openings. Has interior pivoted mounting shoes that provide for easy installation of starter and breaker.

B. The EWC *watertight* control station enclosures are so constructed that they can be exposed to direct stream from a hose during washing down operations. Explosion-proof and dust-ignition-proof, they provide a wide choice of push button stations, pilot lights and selector switches.

C. This *watertight* WMC CONDULET® enclosure has a unique cover hinge so the door can swing either way. It permits grouping several enclosures in a minimum of space. Any standard make of motor starter and circuit breaker fits the WMC.

For controls to meet your exact specifications, contact your Crouse-Hinds distributor or nearest Crouse-Hinds office.

Write for NEW Bulletin 2726 covering the Crouse-Hinds complete line of Motor Controls.



CROUSE-HINDS

CROUSE-HINDS COMPANY, SYRACUSE, N.Y. FIELD OFFICES: Albany, Atlanta, Baton Rouge, Birmingham, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Oregon, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Tampa, Tulsa, Washington. **RESIDENT REPRESENTATIVES:** Baltimore, Md., Meriden, Conn., Reading, Pa., Richmond, Va., Sacramento, Calif., Springfield, Mass. **FOREIGN AFFILIATES:** Crouse-Hinds Company of Canada, Ltd., Scarborough, Ont., Crouse-Hinds-Domex, S.A. de C.V. Mexico, D.F. **MANUFACTURING LICENSEE:** Peterco, Sao Paulo, Brazil.